

MACHINERY

JULY 30, 1958

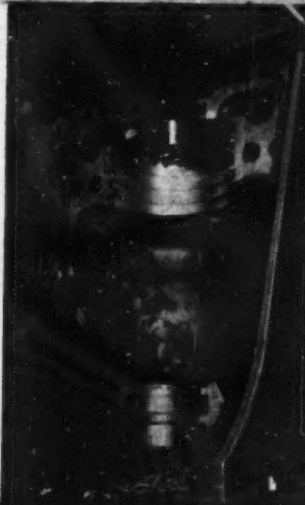
ONE SHILLING & THREEPENCE



RICHARDS

VERTICAL BORING AND TURNING MILL

GEORGE RICHARDS & CO LTD.
BROADHEATH · ALTRINCHAM · CHESHIRE
TELEPHONE · ALTRINCHAM 4242-7
A MEMBER OF THE STAVELEY COAL & IRON CO. LTD. GROUP



INSTALLED AT THE
RUGBY WORKS OF THE
ENGLISH ELECTRIC CO. LTD.
THIS RICHARDS 25FT.
VERTICAL BORING & TURNING
MILL IS ENGAGED IN MACHINING
THE INTERNAL GROOVES IN ONE
HALF OF A STEAM TURBINE
CASING. THE WEIGHT OF THIS
CASTING IS 15 TONS APPROX.



ASQUITH

N.L.D. Radial Drilling Machine
a light-duty machine for
fast, accurate production

This is the ideal radial for many drilling and tapping jobs where comparatively light duty is required, often with a large radial swing. The Asquith NLD is available with maximum radius spindle centre to pillar centre from 3ft. 6in. up to 8ft. Available for early delivery.

Write today for full details.

WILLIAM ASQUITH LTD.
HALIFAX • ENGLAND

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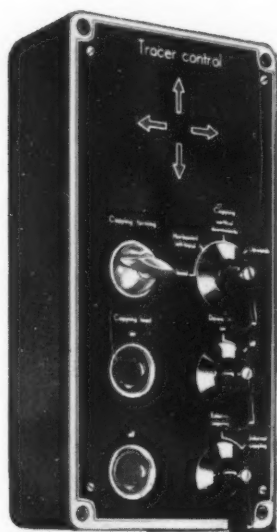
DRUMMOND-ASQUITH

. . . the British Isles

DRUMMOND-ASQUITH (SALES) LTD., KING EDWARD HOUSE, NEW ST., BIRMINGHAM

*Phone: Midland 3431 (7 lines) *Grams: Maxishape, B'ham. Also at LONDON: Phone: Trafalgar 7224 (5 lines) and GLASGOW: *Phone: Central 0922

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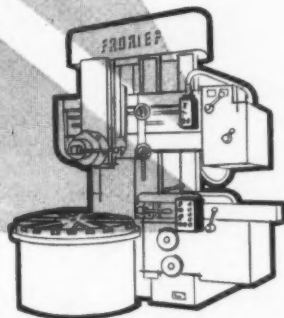


PUSH BUTTON CONTROL

ON THE **FRORIEP** VERTICAL TURRET LATHE



Of the many features which enable this machine to lower materially the cost of production perhaps the most outstanding is its method of control through two control pendants. These pendants contain all control elements for the feed and rapid traverse of the heads in all directions, the setting of the table speeds, the vertical adjustment of the cross rail and indexing the turret head which movement is automatically damped. All the push button impulses are instantly transmitted electrically to magnetic clutches. Operation is simple and manual fatigue is reduced to a minimum.



We would be pleased to send you a booklet on this remarkable machine which gives full details of the controls and all other features. Please write to:

CHARLES CHURCHILL AND COMPANY LIMITED

COVENTRY ROAD, SOUTH YARDLEY, BIRMINGHAM 25. BRANCHES: LONDON, GLASGOW, NEWCASTLE, MANCHESTER



USE **Eclipse** HACKSAW BLADES

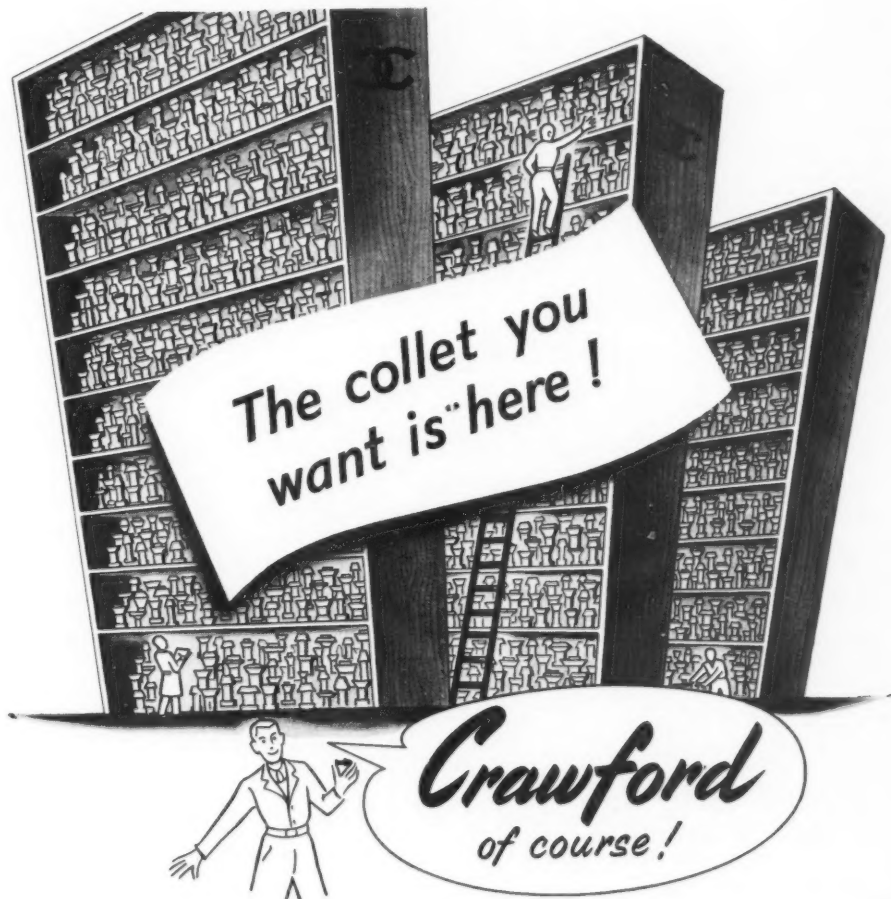
***and
feel
the
difference!***



Made by James Neill & Co. (Sheffield) Ltd. and obtainable from all tool distributors

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UH 28



All standard types in stock

... for precision lathes, watchmakers lathes, milling machines, drilling machines, etc. Crawfords, specialists in collets for more than sixty years, can supply collets of every size and shape, all standard types being held in stock—and specials can always be made to your specifications. Write now for further details.

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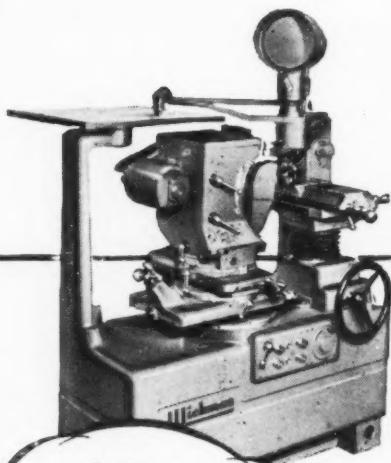
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***When versatility and accuracy
are important***

The range of application possible on the Wickman Optical Profile Grinding Machine is well-nigh limitless. And because templates and formed wheels are not required, single components can be produced quickly with the minimum risk of lost accuracy.

Many years' experience with operators possessing varying degrees of skill has shown that with normal attention forms can be produced to a reliable plus or minus tolerance of 0.0005" and with special care to within 0.0002".

***. . . here's the answer to
form grinding problems***

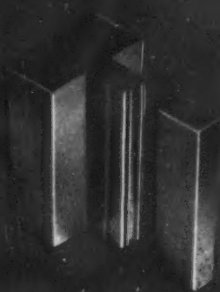


**OPTICAL PROFILE GRINDING
MACHINE**

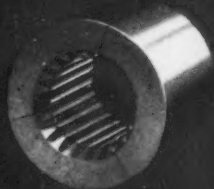
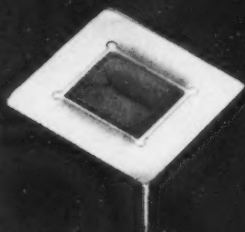
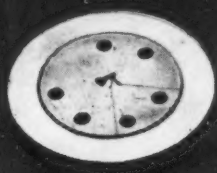
W I C K M A N  L I M I T E D

MACHINE TOOL DIVISION, BANNER LANE, COVENTRY

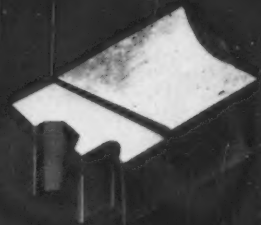
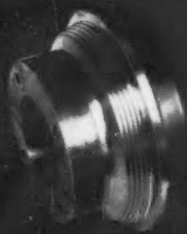
Telephone: Tile Hill 66831



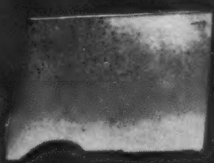
Punch and Die Segments

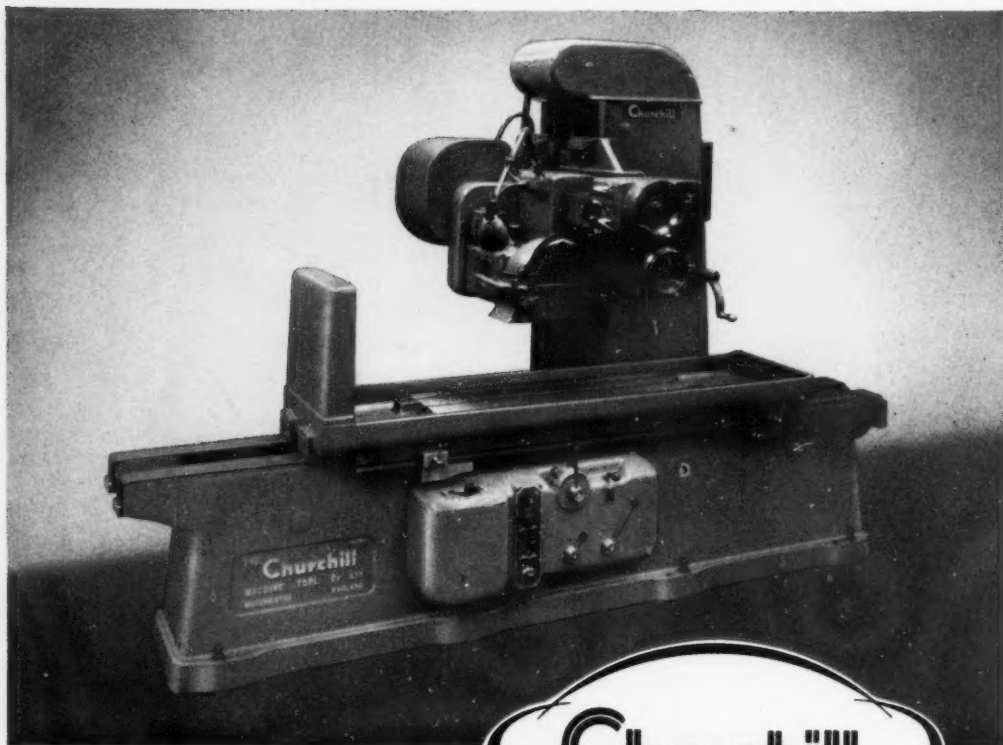


Form Tools



Gauges and Templates





'OSD'

**OPEN-SIDE
SURFACE GRINDING MACHINE**

This heavy duty Horizontal Spindle Surface Grinder fully meets modern requirements for a machine capable of highly accurate work at maximum production rates. Available in three sizes with work table capacities of 30in. by 15in., 48in. by 15in. and 72in. by 15in.

Churchill

Designed for heavy duty and continuous high speed precision working.

Electronically controlled intermittent cross feed. Provision for accurate reversal when grinding recessed faces.

Variable automatic vertical feed with pre-set automatic cut-out.

Hydraulic table traverse up to 100 feet per minute.

Table traverse ways automatically lubricated from oil supply independent of hydraulic system.

Permanently protected precision ground slideways.

Electrically driven slow cross traverse for wheel truing.

Grinding wheel spindle electrically interlocked against starting until lubricating pump is running.



THE CHURCHILL MACHINE TOOL CO. LTD. BROADHEATH, NR. MANCHESTER

Telephone: Altrincham 3262.

Export Sales Organisation:

Home Selling Agents:

Telegrams: Churchale, Manchester

ASSOCIATED BRITISH MACHINE TOOL MAKERS LTD.

LONDON, BRANCHES AND AGENTS
CHARLES CHURCHILL & CO. LTD., BIRMINGHAM AND BRANCHES

PRECISION *plus* PRODUCTION

ABWOOD

SG3H PRECISION

TOOL DIE SURFACE GRINDING

**HYDRAULICALLY
OPERATED**

**RAPID POWER
ELEVATION OF KNEE**

**HIGH PRODUCTION
WITH VERSATILITY**

**SENSITIVE CONTROLS
WITH RUN OUT TO
LOADING POSITION**

**ACCURACY TO .0001"
WITH PERFECT FLATNESS
AND FINISHES TO
1.5 MICRO INCHES
ON SUITABLE MATERIAL**

TABLE WORKING SURFACES



(10) UNDER WHEEL

This latest development model SG3H is "the" Machine for rapid Surfacing in the Toolroom or Production Shop. Detachable Spindles are available for deep and intricate work.

Hydraulic Control allows the operator to "inch" the Table along or stop instantaneously in any position at will.

Auto Run-out of Table to loading position.

Built in Coolant system with separation unit in Base.

Uses 6" Diameter Cylinder Wheels for faster Surfacing and Maximum wheel economy.

LTD., PRINCES ROAD, DARTFORD, KENT

Telegrams: ABWOOD DARTFORD

SG-1

Machinery 7
July 30, 1956



Build your own . . .

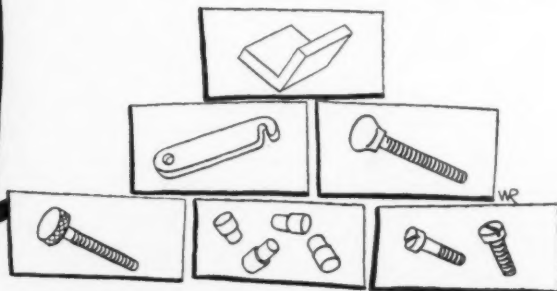
With PUREFOY STANDARD PARTS you, too, can build the finest and cheapest jigs and fixtures. Incorporate them in your designs, use the available tracing templates, and you'll save both time and money in your Tool Room and Drawing Office. We carry large stocks of many hundreds of these items, ranging from accurately machined cast iron sections of many shapes to the smallest heel pin. PUREFOY STANDARD PARTS could be the answer to many of your problems and, remember, we can deliver from stock NOW.

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Information, reports, catalogue, etc., free on request to:—

J. B. PUREFOY UNIT TOOLING LTD. Upper Tilt Works, Cobham, Surrey.

Telephone: Cobham, Surrey 3011



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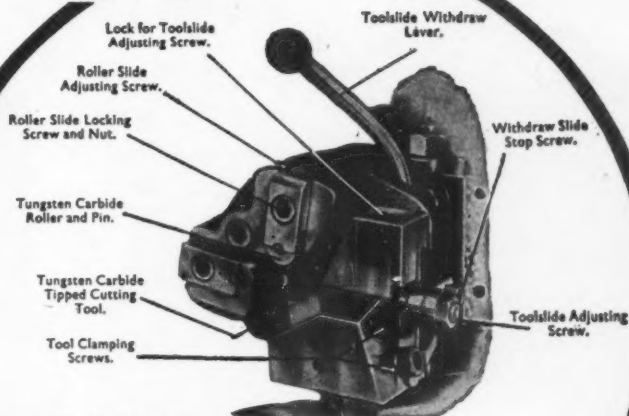
For Heavy Cuts at High Speeds

Ward

Tangential

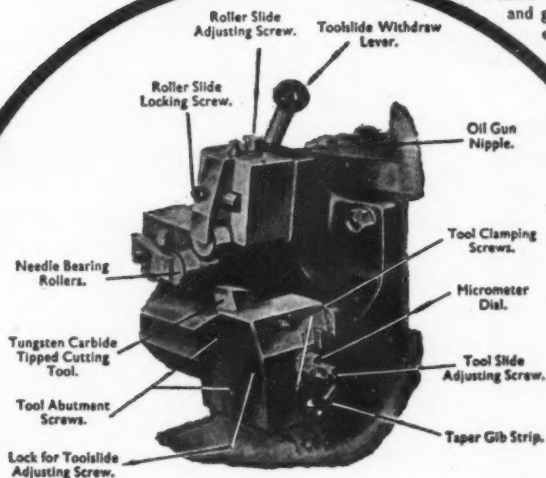
Roller Turning

Toolholders



Type of Toolholder used on Capstan Lathes

Toolholders for capstan lathes have long-life tungsten-carbide rollers and pins allowing maximum speeds to be used without danger of seizure and giving the work an excellent burnished finish.



Type of Toolholder for Turret Lathes

Toolholders for turret lathes have rollers mounted on anti-friction needle bearings and the roller slides have provision for oil gun lubrication.

Constructed for use with tungsten-carbide tools, these holders present the tool tangentially to the work in a quickly set robust slide having micrometer adjustment. Tool relief on return stroke obviates marking work.

**MOST SIZES
FROM STOCK
OR EARLY DELIVERY**

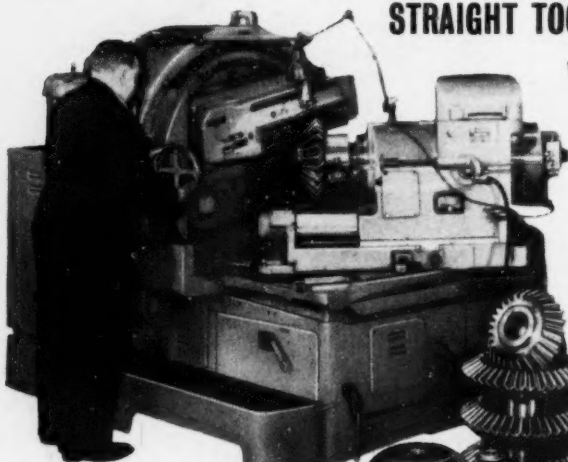


**DESCRIPTIVE
LEAFLETS
ON APPLICATION**

H. W. WARD & CO. LTD.

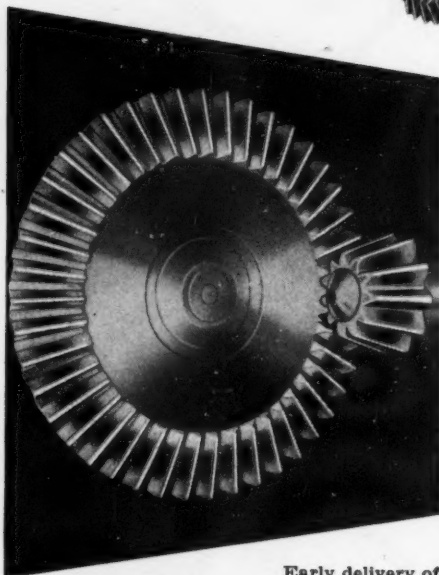
DALE RD., SELLY OAK, BIRMINGHAM 29

INVESTIGATE the advantages of Precision
STRAIGHT TOOTH BEVEL GEARS
 with



We are in a
 unique position
 to offer this feature.

**LOCALISED
 TOOTH
 BEARING**



Gleason No. 24A Coniflex Straight Bevel Gear
 Generating Machine — the latest addition to our
 comprehensive range of gear cutting equipment.

Capacity: mitres 25" diameter

bevels up to 35½" diameter

maximum pitch 1½ D.P.

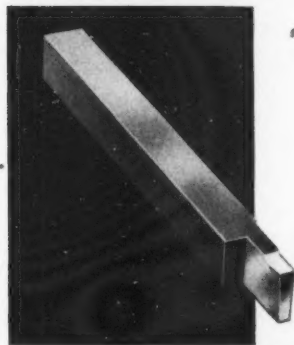
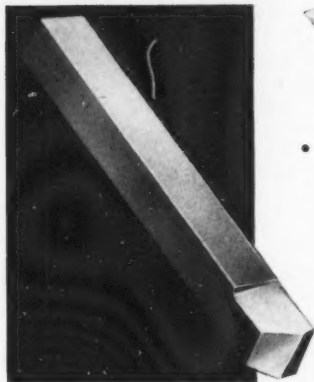
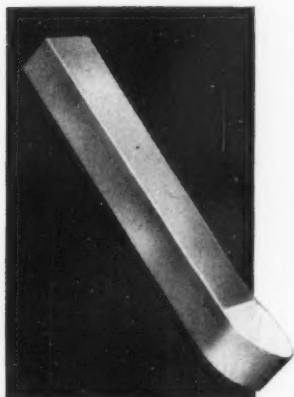
Your enquiries are invited for bevel gears with
 localised tooth bearing and also for spurs up to 8' 6"
 diameter, bevels up to 6' diameter, worms and worm
 wheels, etc.

Early delivery of complete gears or teeth cut in customers' blanks.

CAMPBELLS & HUNTER LTD

SAYNER ROAD, LEEDS, 10. Telephone Leeds 22397. Telegrams Dolphin, Leeds, 10.

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...“the best end by the best means”

Said Francis Hutcheson in 1725; “Wisdom denotes the pursuing of the best ends by the best means.” He couldn't have chosen better words to describe the wisdom of using Stag Major Superweld Tools.

“The best ends”—a generous piece of super high speed steel, not a tip or a thin layer, but a good substantial cutting end.

“The best means”—electrically fuse-butt-welding to a high grade steel shank, giving all the advantages and long life of the finest cutting steel at a fraction of the cost of a solid tool.

Available in a wide range of standard sizes and shapes, or to your own specification.



STAG MAJOR SUPERWELD TOOLS

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For this Booklet post the coupon to-day

To EDGAR ALLEN & CO. LTD. My/ST31.
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Please post data on “Stag Major
Superweld Tools” to—

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Position

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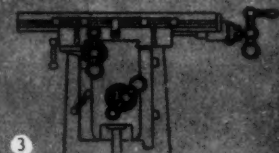
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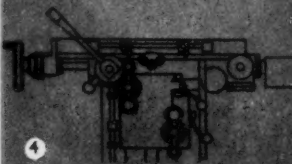
1 Hand Feed—lever, screw, lever.



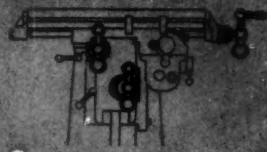
2 Hand Feed—lever, lever, lever.



3 Hand Feed—Screw, screw, screw.



4 Multiform—semi-automatic cycle.



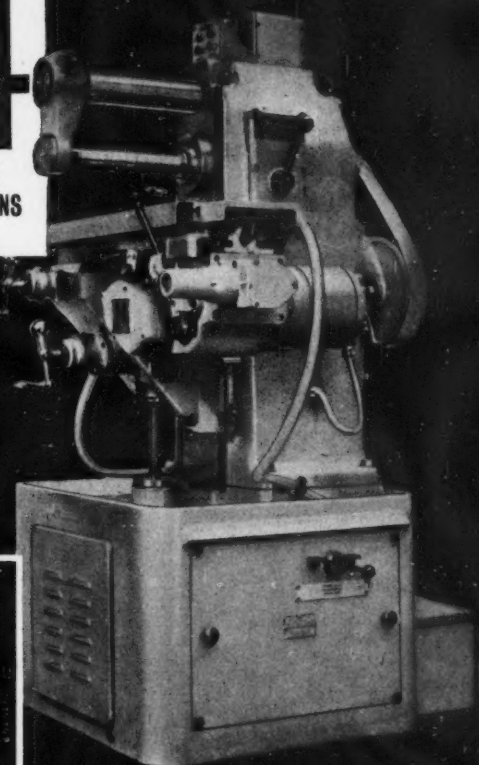
5 Normal automatic feed.

6^x4=24

TYPES OF FEED	SPEED RANGES	POSSIBLE COMBINATIONS
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that's
the
beauty
of the

A & S MODEL '1' HORIZONTAL MILLER



6 With automatic cycle.

WHY PAY FOR 'SPECIAL' FEATURES YOU MAY NEVER USE?

When you equip with A. & S. Model '1' Millers you choose from 4 ranges of speeds and 6 different feed arrangements the best combination* for a particular job. Both hand-feed and automatic types can, however, be supplied with special attachments for special operations. No other small milling machine offers similar versatility or higher production capacity for so wide a range of work.

TABLE 26" x 7"

LONGITUDINAL TRAVERSE	= 10"
VERTICAL TRAVERSE	= 10"
TRANSVERSE TRAVERSE	= 5 1/2"-6"

*With the A. & S. Model '1' brochure in front of you, you would know exactly what we mean.

Built up to a standard—not down to a price

Write for illustrated leaflet.

ADCOCK & SHIPLEY LTD.

P.O. Box 22, Ash Street, Leicester. Telephone: Leicester 24154-6
Telegrams & Cables: Adcock, Leicester.

MACHINERY
12 July 30, 1958

DIXI '60'

SWISS-BUILT

HORIZONTAL OPTICAL JIG BORER



Design Features Include:

- ★ EXCEPTIONAL ACCURACY
- ★ BUILT-IN ROTARY TABLE
WITH OPTICAL SETTING
- ★ INFINITELY VARIABLE
SPINDLE SPEED & TRAVERSE

All scales and dials clearly marked and equipped with optical microscopes for extremely fine reading of co-ordinates. Slide-ways hydraulically actuated. Facing and milling operations also handled. Boring feeds to spindle or table slide as required. An additional Optical Table is available with readings in seconds of a degree, which can be mounted either horizontally or vertically.

Send for detailed catalogue

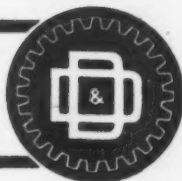
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346 KENSINGTON HIGH STREET, LONDON, W.14

Telephone WESTERN 8077 (8 lines)

Telegrams ACCURATOOL HAMMER LONDON



FREE for welders, welding users, purchasing agents **180 PAGE WELDING DATA BOOK**

A COMPLETE POCKET-SIZE REFERENCE GUIDE

**Includes: CHOOSING THE RIGHT ROD FOR
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INDEXED AND THOROUGHLY EXPLAINED
• TIPS FOR MACHINABLE AND COLOUR
MATCHING DEPOSITS • RECOMMENDED
AMPERAGES • TORCH SETTINGS
AND ELECTRODE TECHNIQUES FULLY
ILLUSTRATED • NEW WAYS TO CUT DOWN
ON WELD METAL**

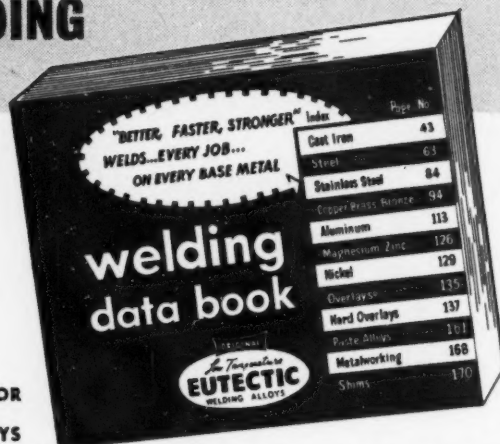
With separate section offering money-saving suggestions on Overlays, Paste Alloys, Cuttings, Preheating, Shims, Flux and Metalworking. Also—an illustrated chapter on Controlling Heat Input . . . how to avoid warping, embrittlement and distortion.



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INDUSTRIES PAVILION
BRUSSELS UNIVERSAL
EXHIBITION**

EUTECTIC WELDING ALLOYS CO. LTD.

NORTH FELTHAM TRADING ESTATE, FELTHAM, MDDX. Telephone FELtham 6571



Here is the completely revised "Eutectic" Welding Data Book for 1958. Thousands of welding users keep this handy book within easy reach—every page is crammed with practical, valuable information—so much so that many call it the welder's 'Bible.' And it's yours free . . . from "EUTECTIC."

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CO. LTD.
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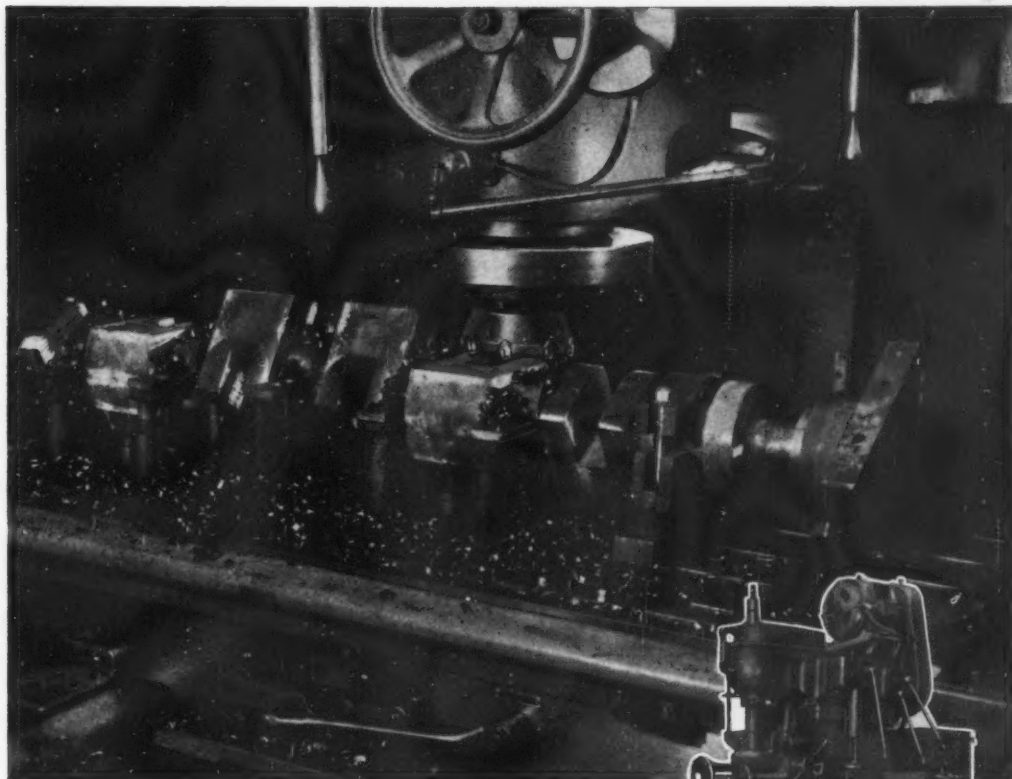
Please send my free copy of
the 180 - page "Eutectic"
Welding Data Book.

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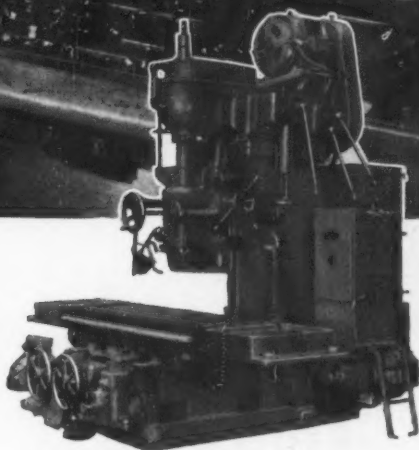
MAC.9



Machining the web faces of a large, carbon-steel, six-throw crankshaft on a Herbert No. 28a Vertical Milling Machine.

A 7" diameter Herbert High-power Carbiface Face Milling Cutter with nine Grade S.200 Ardoloy-tipped teeth, is used for the operation.

Heavy stock removal permits completion of the operation in a total time considerably less than that taken by previous methods.



HERBERT Vertical Milling Machines

No. 47V. Has the power, speeds and rigidity for milling materials from aluminium to high-tensile steels. Thirty-two speeds, 21 to 1,525 r.p.m.; twenty-four feeds $\frac{1}{8}$ " to 60" per min.; quick traverse to longitudinal motion. 48" x 16" x 23".

No. 49V. For heavy work requiring large table capacity. Thirty-two speeds, 21 to 1,525 r.p.m.; electronic feed drive, infinitely variable feeds from 0.8" to 40" per min.; quick-traverse to longitudinal and transverse motions. 62" x 29" x 28½".

No. 28A. For heaviest class of work. Thirty-two speeds, 12 to 540 r.p.m.; electronic feed drive, infinitely variable feeds between 0.8" and 40" per min.; quick traverse to longitudinal and transverse motions. 62" x 29" x 30½".

All models now available for Early Delivery

ALFRED

HERBERT

LTD., COVENTRY



AD.277

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**WILD-BARFIELD
A.H.F.
equipment at
LOCKHEED
HYDRAULIC BRAKE CO.**

A battery of three Wild-Barfield A.H.F. 7½ kW. equipments issued by Lockheed Hydraulic Brake Co. at their Leamington factory for induction soldering tanks to brake master cylinders. Many other industrial concerns have found that Wild-Barfield induction heating speeds production, saves space and offers savings all along the line. Our engineers will be glad to supply further details and explain how Wild-Barfield A.H.F. equipment can help you.



Induction heating speeds production

WILD-BARFIELD ELECTRIC FURNACES LIMITED

ELECFURN WORKS, OTTERSPOOL WAY, WATFORD BY-PASS, WATFORD, HERTS. Telephone: Watford 6091 (8 lines)

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ONE AVAILABLE

EX-STOCK LONDON SHOWROOM!

In a class



of its own

GIDDINGS & LEWIS Model 300 RT

Horizontal Boring, Drilling and Milling Machine

**with Built-in
ROTARY TABLE
(30" x 36")**

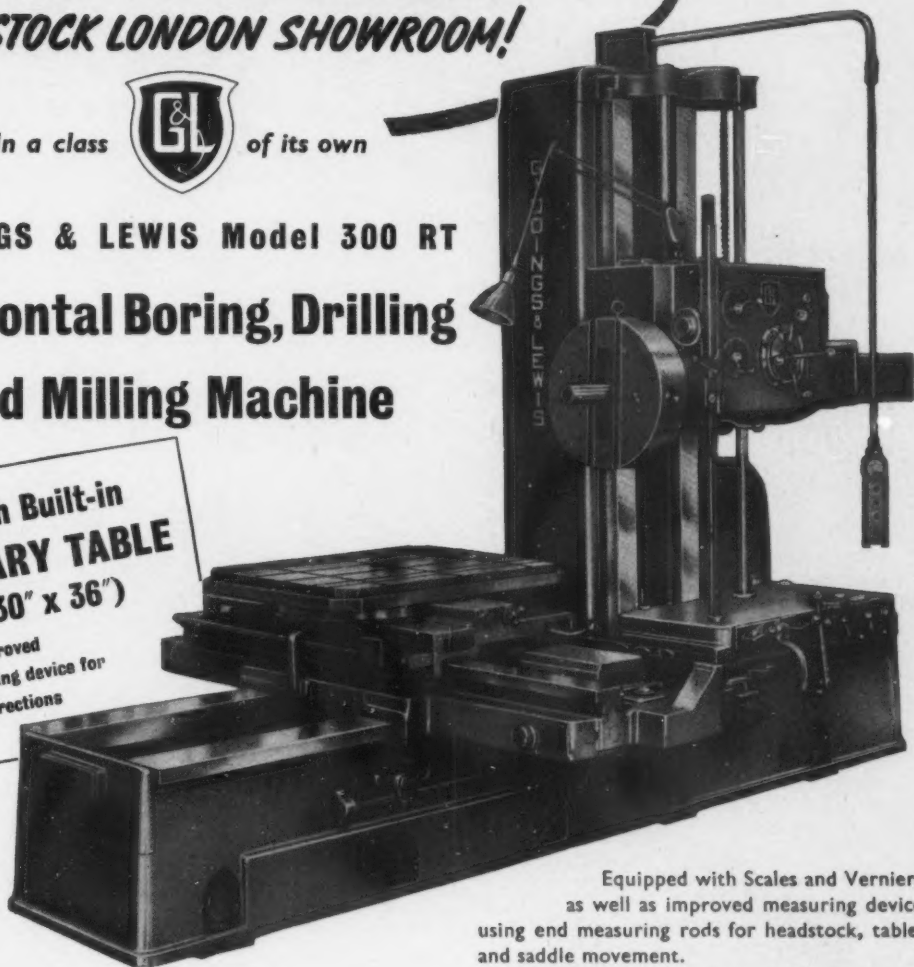
and improved
measuring device for
all 3 directions



Note length
at bed and
vertical
travel of
headstock

BRIEF SPECIFICATION

Dia. of Spindle	...	...	...	...	...	...	...	3"
Length of Bed	...	...	...	...	...	...	...	72"
Vertical travel of headstock	...	...	...	...	...	...	...	45"
Built-in Rotary Table—30" x 36" with 36" cross feed								



Equipped with Scales and Verniers
as well as improved measuring device
using end measuring rods for headstock, table,
and saddle movement.

This machine has all the well-known Giddings
and Lewis features including—Hardened Bed and
Saddle ways, 22" facing head with telescopic
tools, and above all, heavy stock removal coupled
with an exceptional degree of lasting accuracy.

ROCKWELL
MACHINE TOOL CO. LTD.

For further particulars write or telephone **TODAY**

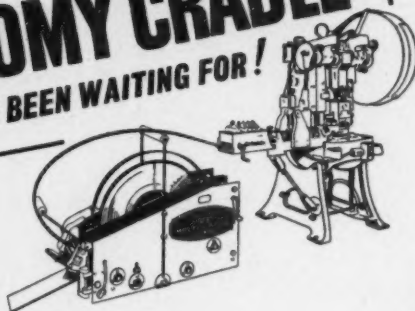
WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0033

ALSO AT BIRMINGHAM—TEL: SPRINGFIELD 1134/5 • STOCKPORT—TEL: STOCKPORT 5241 • GLASGOW—TEL: MERRYLEE 2822

YOUR COIL HOLDING PROBLEMS SOLVED

WITH THE NEW *Fast-Loading*

BRITISH BUILT U.S. TOOL
MULTI-ROLL ECONOMY CRADLE
 THIS IS THE CRADLE *at the price* YOU'VE BEEN WAITING FOR!



One-third H.P. geared motor, output speeds up to 80 feet per minute.

Power-driven, spring-loaded take-out rolls hardened and ground steel, mounted in needle bearings.

Loop control arm actuates mercury switch.

Loop control roller.

Trigger latch swings take-out roll assembly to side for loading.

Quick release lever facilitates threading of take-out rolls.

Mercury switch automatically starts and stops motor.

Adjustable loop supporting roller.

Two inner frames adjustable individually to accommodate stock widths up to 9".

Hand cranks for adjusting inner frames to suit width of coil. Also centre line of coil.

Two sturdy outer frames.

Five coil rest rollers (four power driven) in self-aligning bearings and arranged to equalize weight distribution.

Designed for easy and rapid coil loading, either by hand or by overhead crane.

EARLY DELIVERY

WELSH HARP, EDGWARE ROAD, LONDON, N.W.2. TELEPHONE: GLADSTONE 0033

ROCKWELL
 MACHINE TOOL CO. LTD.

ALSO AT • BIRMINGHAM—TELEPHONE SPRINGFIELD 1134/5 • STOCKPORT—TELEPHONE STOCKPORT 5241 • GLASGOW—TELEPHONE MERRYLEE 2839
 PR 12

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THE

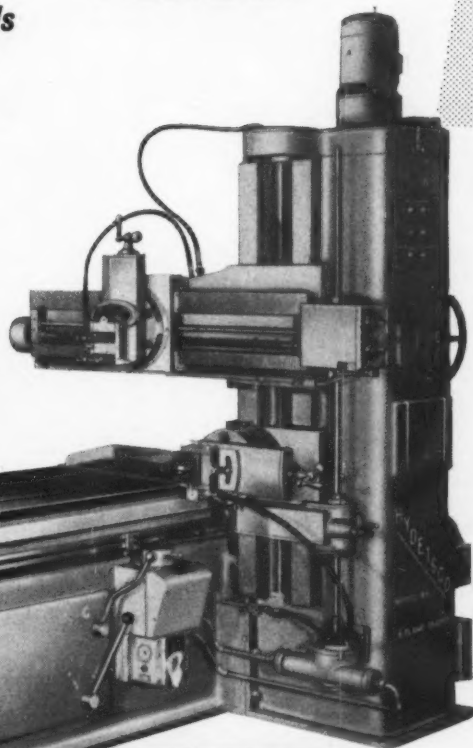
HYDETSO

RANGE OF

**HYDRAULICALLY
OPERATED
PLANERS**

- ☐ ***Infinitely Variable Speeds***
(20-110 FT/MIN)
- ☐ ***Rapid Vertical Traverse***
- ☐ ***Quick Return***
- ☐ ***British Built***

Model 8H has a table working area of 27" x 72", automatic lubrication to bed ways, hydraulic automatic tool lift, centralised controls lessen operator fatigue. Rapid cross traverse to toolhead available if required.

**Model 8H.72" Table Stroke****EARLY DELIVERY****Models available having 3—10ft. stroke.***Write for full details to:—***ELGAR**

RIGHT OPPOSITE NORTH ACTON STN.

**MACHINE TOOL COMPANY LIMITED**

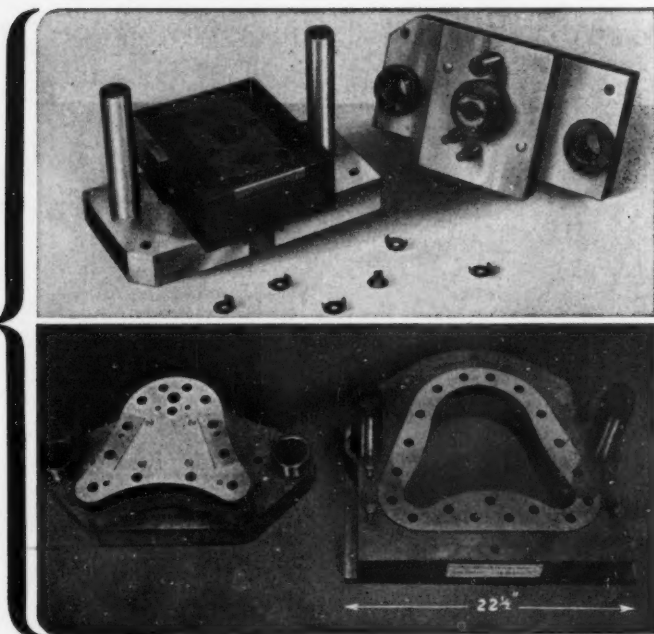
172-178 VICTORIA ROAD · ACTON · LONDON W3 · Telephone ACORN 5555

MIDLANDS SHOWROOM: 1075 KINGSBURY ROAD, BIRMINGHAM 24

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NRP.2143

476



BECAUSE of its high chromium and carbon content, 476 Steel resists wear and is specially suited for exacting punching and forming operations on abrasive materials. It has also considerable toughness, the tool edges standing up to shock applications, such as heavy punching and shearing. The photographs illustrate two contrasting applications. (Top) Three stage press tool for punching and forming clamping washers from brass strip (courtesy, Clarke Chapman & Co. Ltd.). (Bottom) Heavy press tool for blanking hoist bracket in $\frac{1}{4}$ " thick mild steel (courtesy, Stothert & Pitt Ltd.). 476 is

air hardening and machinable in the annealed condition. Applications include blanking dies and punches for sheet brass, copper, zinc, high silicon transformer steels and hard abrasive materials generally; blanking tools for steel sheet and plate; blades for flying strip shears and plate shears; deep drawing dies, cupping dies, forming dies; sheet metal forming rolls; circular cutters for strip; trimmer dies, thread rolling dies; gauges and other precision tools; taps, staybolt taps; brick mould liners; master hobs for cold hobbing plastic moulds; cut moulds for plastics.

SANDERSON'S

SANDERSON BROTHERS AND NEWBOULD LIMITED

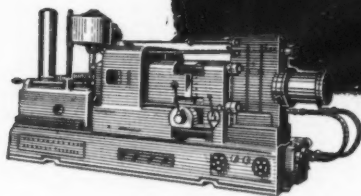
Attercliffe Steelworks, P.O. Box 6, Newhall Road, Sheffield 9

ESTABLISHED 1776

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HARPER CASTINGS for our
melting pots are highly successful
say E. M. B. CO. LTD. makers of
die casting machines



*Harper quality covers Grey Iron,
Spheroidal Graphite Iron (Mond
Nickel Licence) and Meehanite
castings.*

*Also metal pressings, machining,
enamelling and other finishes
and sub-assembly work.*

The melting pots for the E.M.B. No. 14 Die Caster are made from Harper Meehanite Castings chosen by E.M.B. because (1) They withstand thermal and mechanical shock. (2) Have good machining qualities. (3) Are dimensionally accurate and of uniform quality (4) Give vastly improved life.

Since they changed to Harper Meehanite Castings E.M.B. have had no trouble with their furnace pots on machines injecting metal between 8 and 25 shots per minute ... "These remarkable figures would not be possible without Harper Meehanite Castings," say the makers.

HARPER CASTINGS



JOHN HARPER & CO. LTD. JOHN HARPER (MEEHANITE) LTD.
ALBION WORKS Phone: WILLENHALL 124 (5 lines) Grams: HARPERS, WILLENHALL **WILLENHALL**

LONDON OFFICE: SEAFORTH PLACE, 57, BUCKINGHAM GATE, LONDON S.W.1 Tel.: TATE GALLERY 0286

MANCHESTER OFFICE: c/o B. J. Brown & Partners Ltd. 248/9 Royal Exchange, Manchester 2

H 649

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why pick on us?

Lines Brothers hailed us aboard to pressure die cast their Tri-ang model outboard motor "Swordfish."

By helping to simplify the design, we were able to do the job in five aluminium alloy castings, combining lightness and strength. Time, money and labour were saved—as they invariably are when you pick on us. We're ready to produce aluminium or zinc base alloy castings in almost any size or quantity...except, if you please, very tiny castings or very short runs.

the whole in one

BRITISH DIE CASTING AND ENGINEERING CO., LTD.

EDWARD ROAD · NEW BARNET · HERTS · TEL: BARNET 9211
ALSO AT WEST CHIRTON TRADING ESTATE NORTH SHIELDS
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ELB

LARGE WHEEL SURFACE GRINDING



is periphery grinding at its best.

A large dia. wheel is used and fed across the work rapidly, spreading the cutting load over a wide area of the wheel, resulting in smooth and fast metal removal and low wear.

Non-compound table allowing a solid support in any position. Direct spindle drive avoiding loss of power. Special paraffin lubricated bearings running with the very minimum of play. Heavy cross-moving wheel head column assuring constant accuracy.

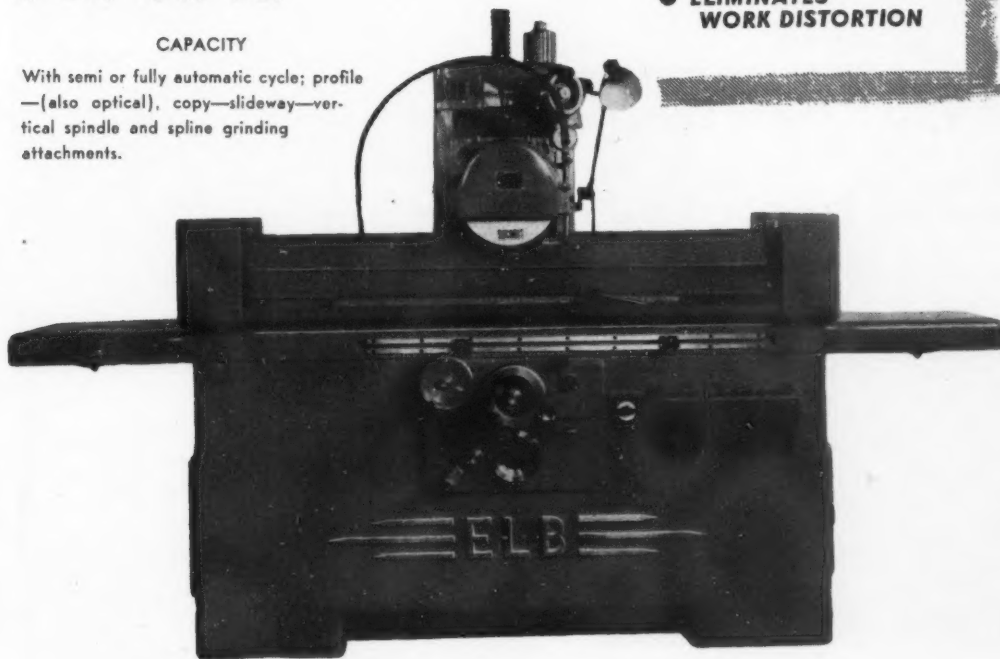
MADE IN 8 SIZES FROM

16" x 10" to 80" x 20"

CAPACITY

With semi or fully automatic cycle; profile —(also optical), copy—slideway—vertical spindle and spline grinding attachments.

- CUTS COSTS
- SPEEDS OUTPUT
- IMPROVES FINISH AND ACCURACY
- ELIMINATES WORK DISTORTION



See a demonstration at our Battersea works

SOAG MACHINE TOOLS LTD., LONDON

JUXON STREET, LAMBETH, S.E.11 : Tel: RELiance 7201 : Grams: SOTOOLSAG, LONDON, S.E.11

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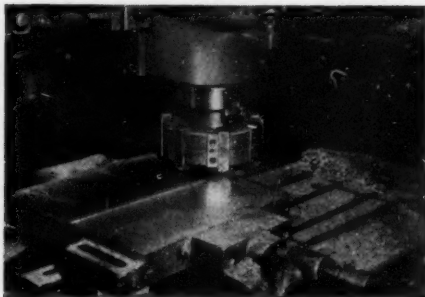
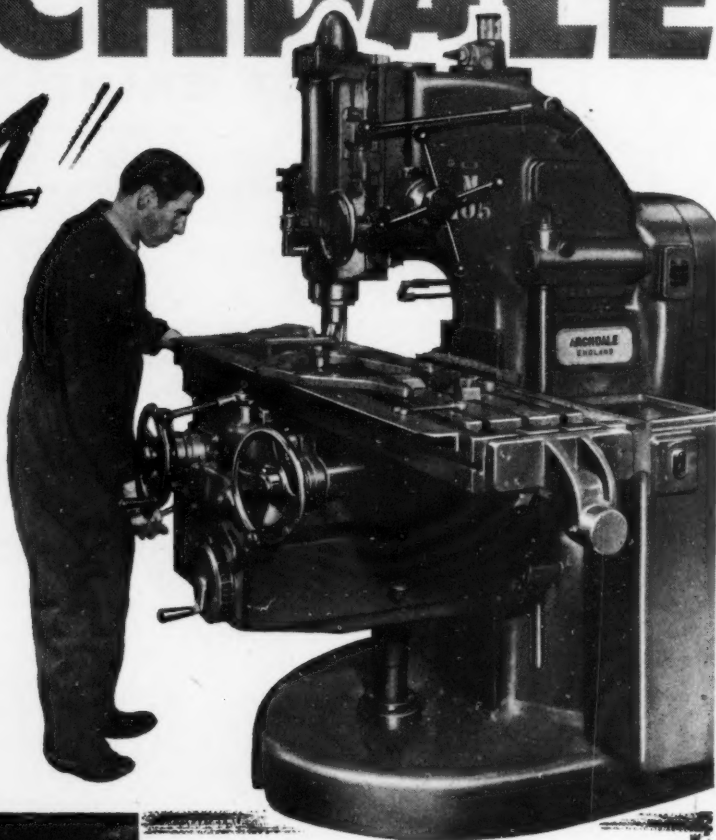
34"

VERTICAL

✱ versatile

✱ powerful

**CUTS COSTS
AT FORGROVE
MACHINERY CO., LTD.**



**JAMES ARCHDALE & CO. LTD.
LEDSAM STREET, BIRMINGHAM, 16.**

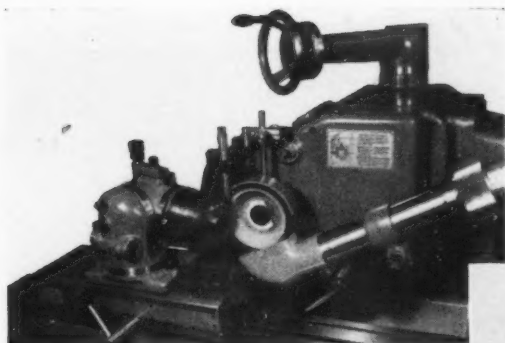
Telephone No. 2276

A Member of the Staveley Coal & Iron Co. Ltd. Group
Sole Agents: **ALFRED HERBERT LIMITED,**
COVENTRY Telephone No. 39881

This massive, powerful and versatile machine makes light work of heavy duty milling on a variety of jobs at Forgrove Machinery Co. Ltd., Leeds.

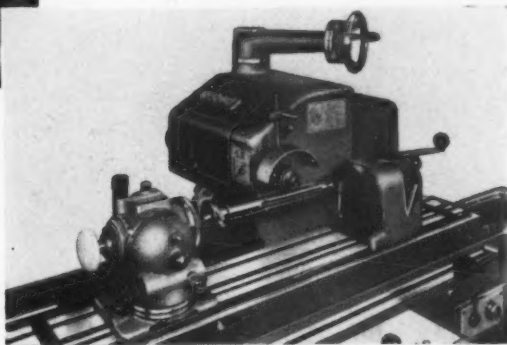
Table has reversible automatic feeds and quick power traverse in all three directions. Speeds and feeds changed from front of machine. Direct reading dials. Twelve speeds from 29/520 r.p.m. or alternatively 36/638 r.p.m. Twelve feeds, $\frac{1}{4}$ " to 20" per minute. Quick and fine hand adjustment to spindle. Table working surface 53" x 14 $\frac{1}{2}$ ".

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*precision
grinding
with ---*

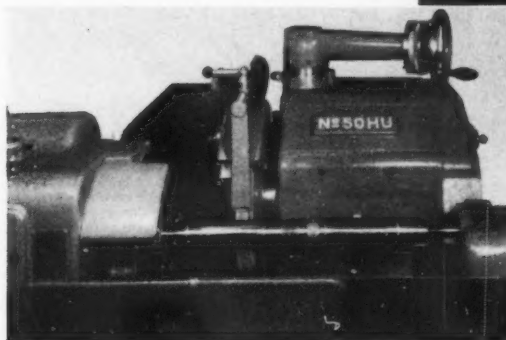
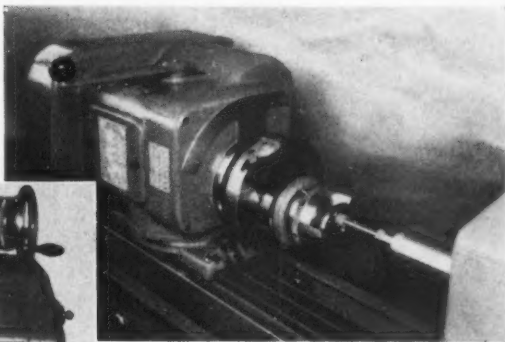
**The ideal machine for FACE,
CYLINDRICAL, INTERNAL
SURFACE, TOOL AND
CUTTER grinding.**



--- KELLENBERGER *universal grinders*

Features include adjustable table for taper grinding; wheelhead and workhead with 360° swivel. Six rates of automatic table traverse. Automatic in-feed to wheelhead.

Three sizes 29½", 46½" and 59" between centres.



Kellenberger also offer a Tool and Cutter
Grinder with 30½" or 36½" between centres.

Full details from sole agents:—

ALFRED

HERBERT

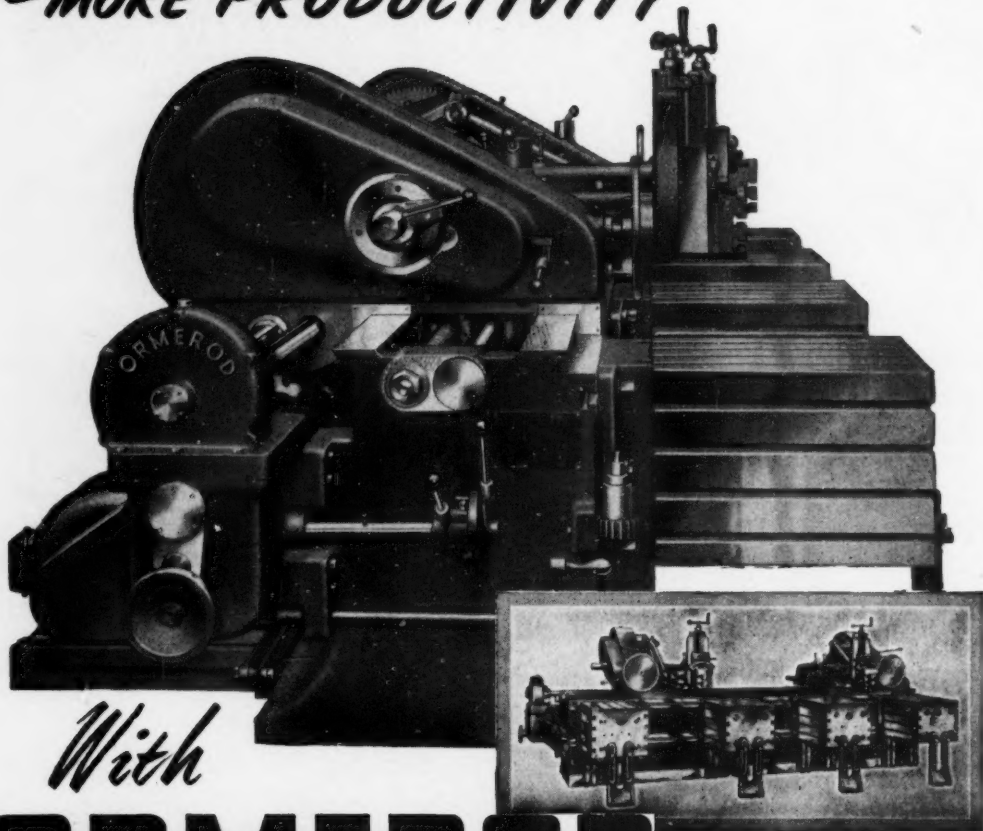
LTD., COVENTRY

Factored Division, Red Lane Works.



AD432

**MAXIMUM FLEXIBILITY
- MORE PRODUCTIVITY**



With
ORMEROD
High Speed **SHAPING MACHINES**
Twin Traversing Head

These versatile machines take in their stride work of the most unusual size and shape. Machines with two heads are capable of simultaneous and independent machining of a single piece. Each nine-speed ram has a swivelling toolhead, self-acting vertical feed and automatic tool lifter. Available in four sizes with one head and two tables and two heads and two tables; the lengths of stroke are 16in., 20in., 26in., and 32in., with lengths of bed to suit requirements.

ORMEROD SHAPERS LIMITED

HEBDEN BRIDGE - YORKS ENGLAND

Telephone: 17 and 313 HEBDEN BRIDGE

'Grams: SHAPERS, HEBDEN BRIDGE

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How long by your methods?

This six inch long spanner body die was formed in six hours using a GKN Spark Machine. The die required no further finishing before use.

GKN Electro Erosion simplifies intricate shaping; —makes easy the working of hardened steels and tungsten carbide.

A GKN Spark Machine gives a high cutting rate

with low electrode loss and a good surface finish for dies, moulds, press tools and form tools of the difficult and intricate nature. Its operation is safe, simple, speedy, and accurate.

Further details of the GKN Spark Machine and its many advantages can be obtained without obligation from Welsh Metal Industries or Sales Agents.

GKN spark machine

DESIGNED BY THE GKN RESEARCH LABORATORY

Manufactured by

WELSH METAL INDUSTRIES LTD., Caerphilly, Glamorganshire

Sales Agents

M. C. Layton Limited, 96-98 Victoria Street, London, S.W.1.
Rudkin & Riley Limited, Cyprus Road, Aylestone, Leicester

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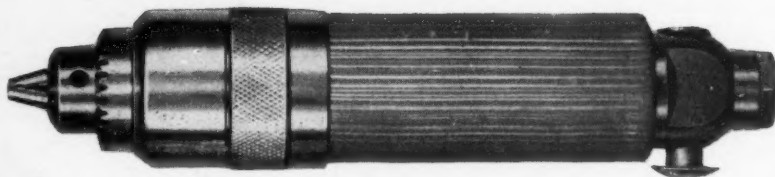


Never satisfied! Always improving! A steady progress towards perfection — burbled the Managing Director in his most self-satisfied voice. Take Pneumatic Drills. Efficient, you say—but perhaps a trifle noisy for the assembly line.

Sir, you are living in the past. This Little Horse here ("this 'ere Little Horse, if you please" muttered the Little Horse in question) operates a drill. Note that we have fitted him with a kind of gag or muffler, thus reducing the operating noise level by more than 50%. The principle is really very simple—as I will now demonstrate. I place this muffler over my mouth . . . so . . . I will now ask any member of the audience to wrap the ends—thank you sir,—round behind my ears . . . and N'mm M'mm Er'rm Ah'rmm Hurh'mm mm-m-mm . . .!

(The audience agreed that the noise level had indeed dropped by well over 50% and the Managing Director was carried out, black in the face, amid loud cheers).

These drills are now fitted with a chuck guard silencer and an improved plastic grip. Let us send you a leaflet giving you full details of the whole new range.



THE NEW **DESOUTTER** **SILENT DRILLS**

Manufactured by Desoutter Bros., Ltd., London.

DESOUTTER BROS. LIMITED, THE HYDE, HENDON, LONDON, N.W.9.
TEL: COLINDALE 6346. GRAMS: DESPNUCO, HYDE, LONDON.

CRC 281B

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If you face mill light alloys . . .



*here's how to put
your finger on
60% more production!*

The latest Wadkin Articulated Arm Router has considerably increased output rates and drastically reduced production costs in scores of shops. The reason is this: Wadkin machines are not orthodox millers but machines specially designed for high-speed working in Non-ferrous Metals. With cutting speeds up to 18,000 r.p.m. and low tooth loading of the cutter, face-milling operations are accurately machined in a fraction of the time taken by any other method, and only light clamping of the component is necessary. No further finishing operation is required. May we prove the amazing output capabilities of this machine—preferably by a demonstration on your own job.

A Wadkin Articulated Arm Router, type L.C. face-milling a filter plate at Brytallium Castings (Bolton) Ltd., Bolton. A finished component is shown in the foreground.



Wadkin

Wadkin Ltd., Green Lane Works, Leicester, Tel.: 68151. London Office: 62 Brook St., W.1. Tel.: MAYfair 7648

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C2



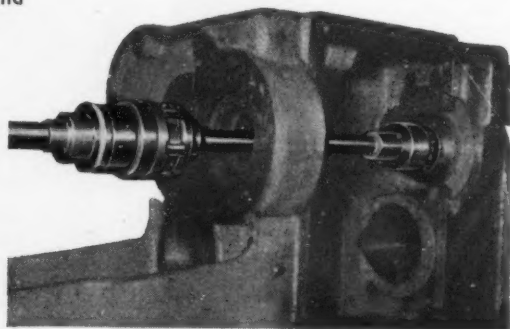
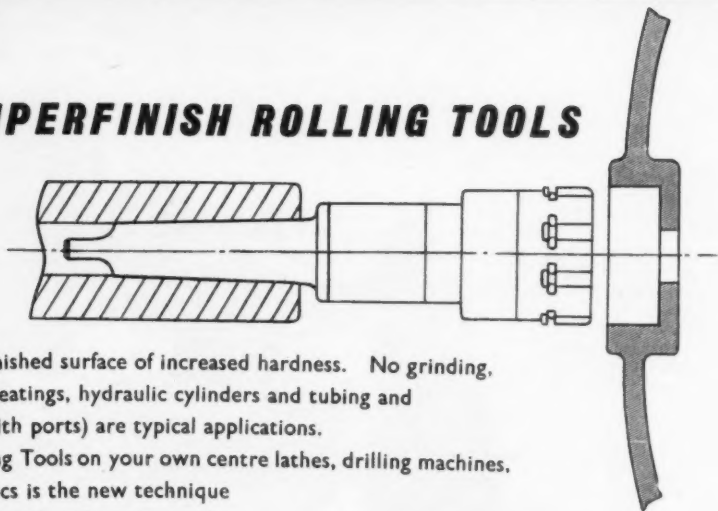
**Today's revolutionary
technique — SIZE AND
SUPERFINISH BY COLDFORMING WITH**

"RODO" SUPERFINISH ROLLING TOOLS

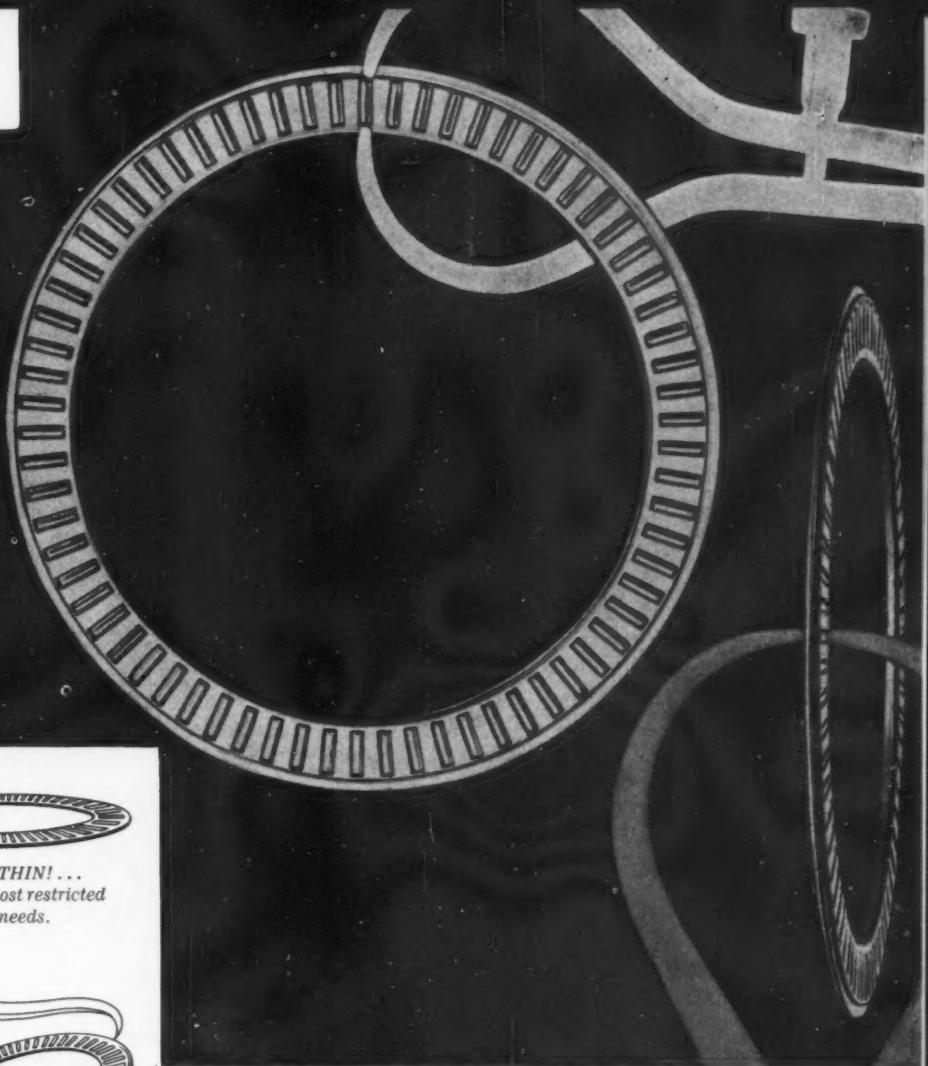
With 'Rodo' Rolling Tools
you can go straight from a
pre-machined bore to a close

tolerance bore with a superfinished surface of increased hardness. No grinding,
lapping or honing. Ballrace seatings, hydraulic cylinders and tubing and
bores in valve bodies (even with ports) are typical applications.

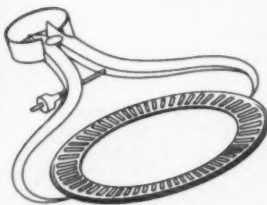
Coldforming by 'Rodo' Rolling Tools on your own centre lathes, drilling machines,
boring machines and automatics is the new technique
for finishing blind and through holes of any size and
length in almost any material. May we give
you fuller information?



MACHINE SHOP EQUIPMENT LTD., SPENSER STREET LONDON. S.W.1 Telephone VICTORIA 6006.



*It's .0781" THIN! ...
to meet the most restricted
space needs.*



*OD is much smaller,
for given shaft size, than
other types of thrust bearings.*



*Needle-proportioned rollers
provide large contact area
in minimum cross section.*

By every measure ... ideal for compact thrust applications

Whether you gauge its value in compactness, high anti-friction efficiency, high thrust capacity, or low unit cost, you will find the new Torrington Needle Thrust Bearing measures up ideally to your needs.

This needle-type bearing is designed specifically for thrust loads in restricted space. It may run directly on adjacent hardened and ground surfaces or on thrust races which may be simply and economically produced to suit individual design requirements. Used alone, or in combination with Torrington radial type Needle Bearings, the Needle Thrust Bearing finds wide use in many applications including steering gears, hydraulic pumps, tractor bolsters, bevel and worm gear boxes, governors, outboard motors, 2-cycle engines, washing machines, power tools, torque converters, and automatic transmissions.

Please write to our Bearings Division for catalogue 758 and call upon our services for assistance in design.

ΦB/58/E

TORRINGTON BEARINGS

THE TORRINGTON COMPANY LTD. BEARINGS DIVISION: TORRINGTON AVENUE, COVENTRY
LONDON & EXPORT OFFICE: 7-10 ELDON STREET, E.C.3. GLASGOW OFFICE: 14 MOIR STREET G1



A Cut above the rest...

Strasmann Cobalt Steel Milling Cutters are designed for rough machining high tensile steels and other tough materials. The thread form gives single point cutting action which is admirably suited to the removal of metal in bulk. The finish left by these cutters is slightly wavy, and as the surface is not glazed, finishing with conventional cutters is simplified.

★ **STRASMAN REAMERS**

Strasmann Machine Reamers also manufactured from cobalt steel are designed for through hole reaming in all metals. Good finish, straight holes are possible at high production rates. Hole sizes are constant and regrinding does not affect the diameter.



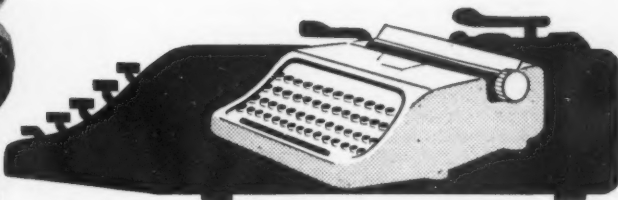
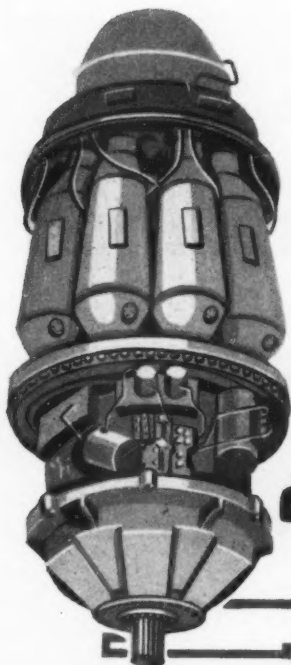
TE ROY
LTD

TEROY LTD., CENTRAL HOUSE • FRATTON BRIDGE • PORTSMOUTH
PORTS 33217/8

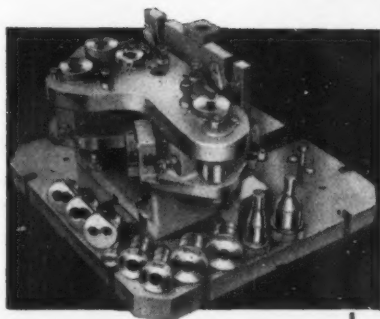
Sole distributors for Strasmann Roughing Cutters and Reamers in the U.K., would be pleased to send you literature and arrange a demonstration. Enquiries for special requirements are gladly invited.

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whatever
your
product...



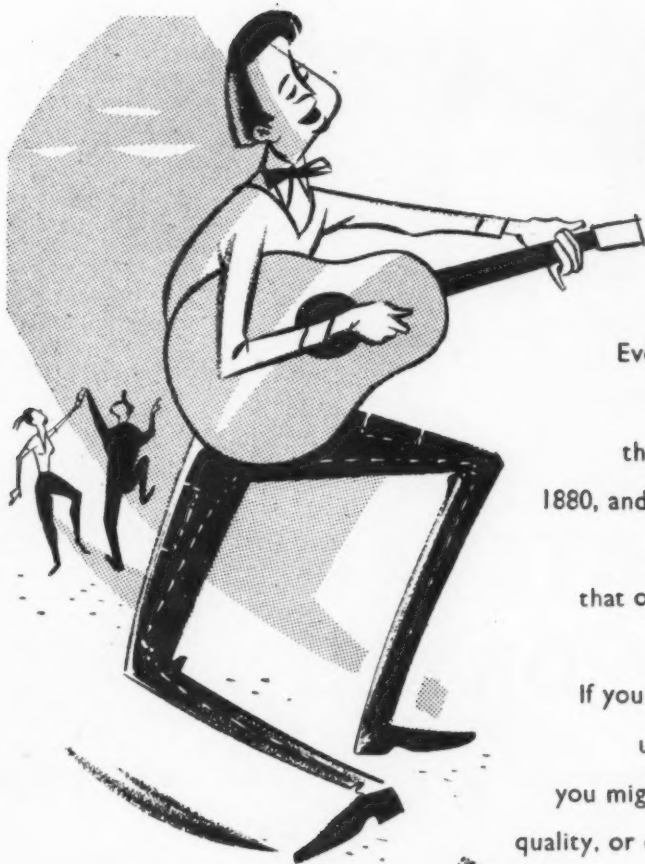
can offer a
complete service



The Birmingham Tool & Gauge Company offers an unsurpassed service to an ever-increasing number of manufacturers in diverse fields of metal working. Although primarily manufacturers of special cutting tools of every description, both in High Speed Steel and Tungsten Carbide, our capacity embraces high quality precision engineering work and the manufacture of jigs, fixtures and inspection gauges. The same rigid adherence to meticulous standards of quality and finish that has always been reflected in our range of cutting tools, for which we have been renowned for nearly half a century, is now strictly observed in our new fields of activity.

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SOHO HILL, HANDSWORTH, BIRMINGHAM, 19
Telephone: NORthern 3344 Telegrams: Relief, Birmingham, 19
London Office: 26 Holborn Viaduct, London, E.C.1
Telephone: Fleet Street 6454 Telegrams: Birmtool, Cent, London

Beardmore



**WE ARE
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WHATSOEVER!**

Every job in our works is under the personal supervision of the owners, as it has been since 1880, and in that we are old fashioned.

But a visit will quickly prove that our plant and our methods are right up to the minute.

If you have a production line which uses gears for which you think you might improve price, or quality, or delivery . . .

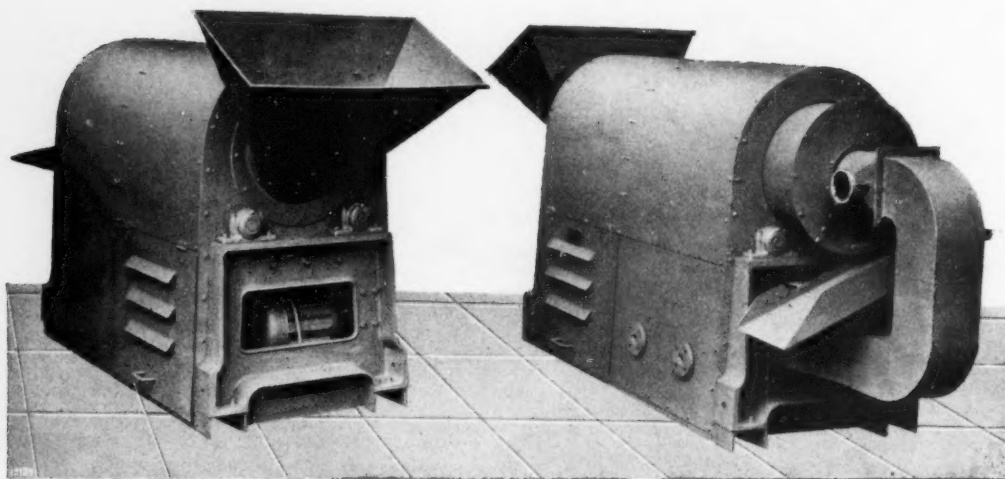
**YOU WILL
BE GLAD
YOU CONTACTED . . .**

★
CAPACITY 8" dia. x 10 d.p.
to 1" dia. 64 d.p.



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The STURTEVANT ROTARY DRYER

for the *rapid drying of small metal parts*

It is specifically designed to deal with small metal items from washing after pickling, plating or similar processes. It is fully automatic in operation and the design and construction permit the process to be carried out on a continuous basis.

For further particulars please write to our reference MY/101/DW.

STURTEVANT

ENGINEERING CO. LTD.

Southern House, Cannon Street, London, E.C.4

AUSTRALIA

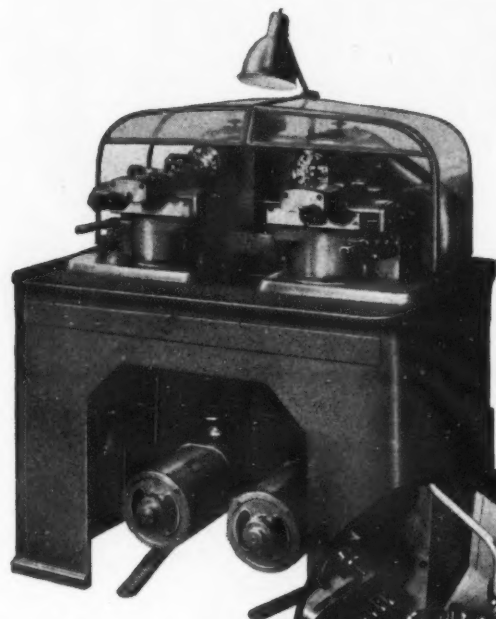
STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD. 400, SUSSEX STREET, SYDNEY, N.S.W.

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40 Years experience is built into today's—



KUMMER

MR 6020

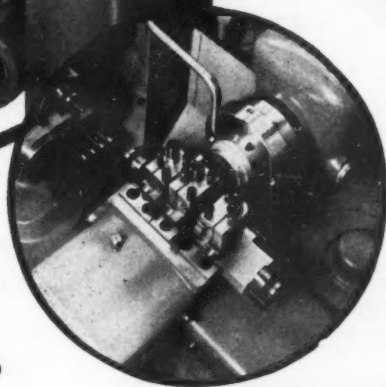
TWO-SPINDLE PROFILING CHUCKING AUTOMATIC

For precision turned parts of any form up to $3\frac{1}{2}$ in. diameter with a maximum forward stroke of $\frac{3}{8}$ in.

Economical for machining short runs—as few as 100 pieces

POINTS TO NOTE!!

- VERY LOW TOOL-ING COSTS
- POSITIVE CAM FEED
- ADJUSTABLE STOPS
- EASY SETTING AND EXTREMELY SHORT CHANGE-OVER PERIODS
- ECONOMICAL FOR MACHINING SHORT RUNS



*Also available—
a complete range
of turning machines
for the watchmaking
industry & watchcase
manufacturers*

Write for full details to Dept. M4

GASTON E. MARBAIX LTD

DEVONSHIRE HOUSE VICARAGE CRESCENT
BATTERSEA, LONDON S.W.11
PHONE BATTERSEA 8888 (8 lines)



ACHIEVEMENT IN STAINLESS STEEL CASTING

We must confess that we at BAKER'S are rather proud of this stainless steel casting. It involved a very difficult core technique to produce an internal spiral hole, true to size and with a good surface finish.

If you require carbon or alloy steel castings, simple or complicated, in large batches or small, from a few pounds up to 30 cwts., you can rely on BAKER'S OF NEWPORT to meet your most exacting demands.

Bakersteel

**CARBON AND ALLOY STEEL CASTING
UNSURPASSED FINISH AND QUALITY**

W. A. BAKER & CO. LTD., WESTGATE WORKS, NEWPORT, MON., PHONE: NEWPORT 64845
DIVISION OF BLACK-CLAWSON INTERNATIONAL, LTD., MAKERS OF PAPER MILL PLANT

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CEJ

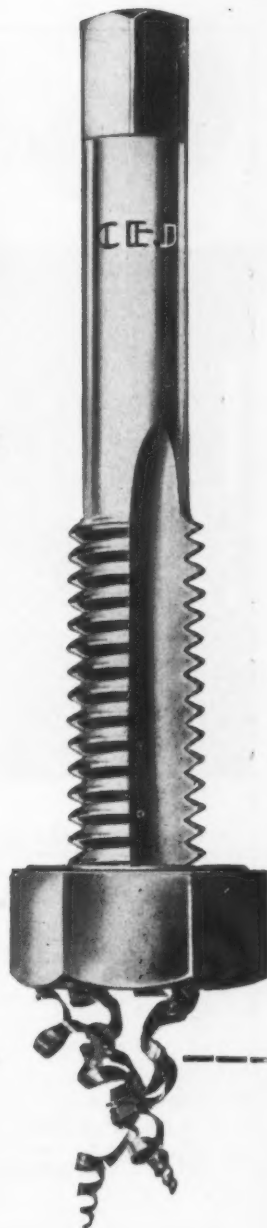
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CEJ PRODUCTS

Ground Thread Taps
Chaser Dies
Screw Plug Gauges
Screw Ring Gauges
Circular Chasers and
Holders
Round Dies
Thread Milling Hobs
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Surface Finish Indicators
Micrometers
Bore Gauges
Deltameters
(Automatic Sizers)
Drill Chucks
Gauge Blocks

Dynamometers
Extensometers
Plain and Screw Snap Gauges
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Tapping Attachments
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CEJ OHANSSON LTD.
PRECISION TOOLS AND INSTRUMENTS

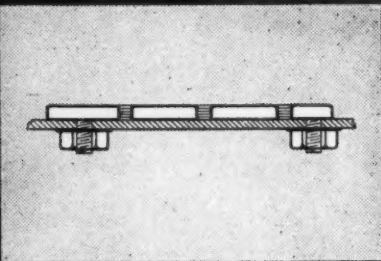
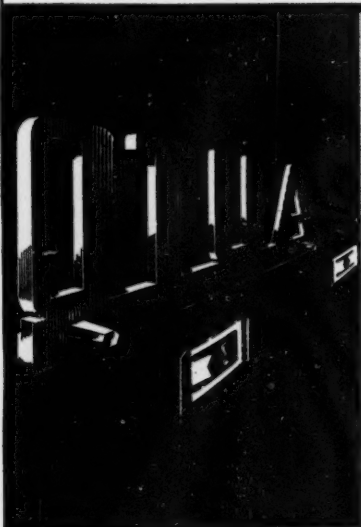
A.I.D. AND A.P.I. APPROVED

SOUTHFIELDS ROAD, DUNSTABLE, BEDS • TEL: DUNSTABLE 422/3/4

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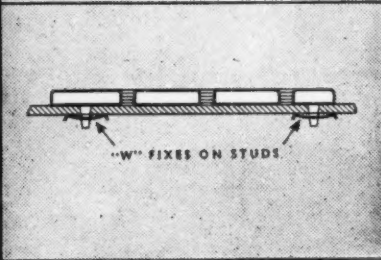
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The logical advance in Retaining



OLD WAY

Threaded studs were spot welded (or inserted if die-cast) to the nameplate. To hold this in position, washers and nuts were laboriously assembled with great difficulty especially on blind applications.



THE SALTER WAY

Studs are cast in with the nameplate, and the Fixes are simply pushed on, even on blind applications. The whole is firmly retained with an even spring tension.

save material — reduce assembly time — cut costs

When it's a question of assembling components in any engineering field, Salter Retainers are the answer. They replace nuts and bolts, screws, cotter pins, and eliminate expensive threading

and machining operations. A large standard range is at your immediate disposal, and we should welcome the opportunity to assist in developing special retainers to solve your problems.

Send for the Salter Retainer catalogue — no designer is complete without it.

NEATER — MORE POSITIVE — PERMANENT RETAINING

SALTER

TRADE MARK



Circlips



Fasteners



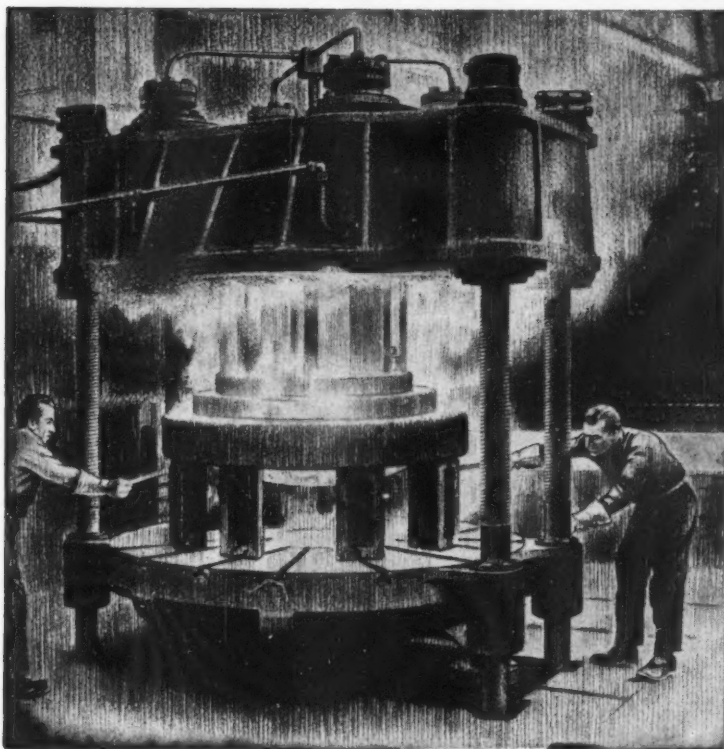
Retainers



Fixes

Geo. Salter & Co. Ltd., West Bromwich · Spring Specialists since 1760

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DISHED and FLANGED ENDS



Fabrication of pressure vessels may be greatly facilitated by drawing upon Harvey resources for the production of die-pressed Dished and Flanged Ends.

Capacities range from 6in. to 9ft. diameter. Edges are prepared for welding or riveting if desired.

STOCK SIZES: Ends pressed from Boiler Quality or Ship Quality Mild Steel up to $\frac{1}{2}$ in. thickness, in most sizes up to 7ft. diameter, are normally available from stock.

SEMI-ELLIPSOIDAL HEADS can be produced on the Rotarpress; diameters 5ft. to 15ft.; thicknesses $\frac{1}{2}$ in. to 4in.

For details, please ask for List No. MN 965

Harvey

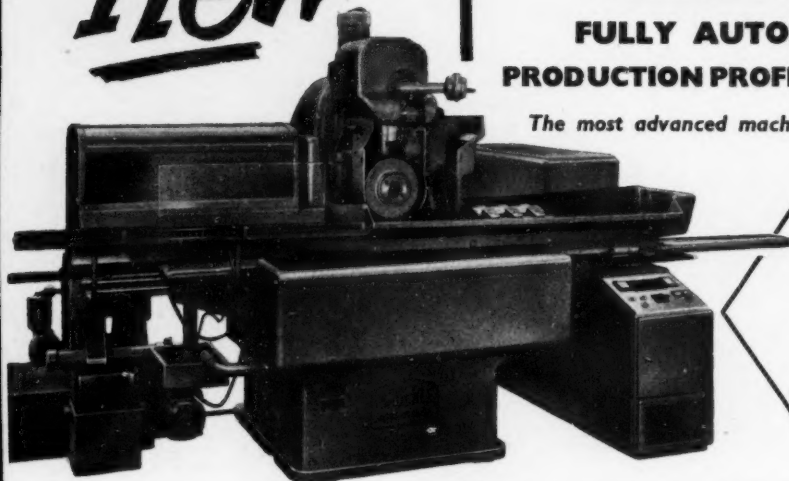
G. A. HARVEY & CO. (LONDON) LTD., WOOLWICH ROAD, LONDON, S.E.7. Phone: GREENWICH 3232 (22 LINES)

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new



MÄGERLE

FULLY AUTOMATIC PRODUCTION PROFILE GRINDER

The most advanced machine of its type

ENTIRELY
AUTOMATIC
EXCEPT FOR
LOADING &
UNLOADING

THREE SIZES WITH WHEELS UP TO 4in. WIDE

MODEL FP 7A TABLE WORKING SURFACE 29½in. by 9⅞in.

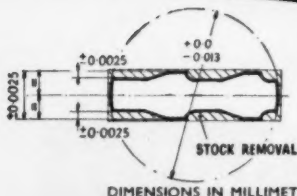
MODEL FP10A TABLE WORKING SURFACE 41½in. by 9⅞in.

MODEL FP12A TABLE WORKING SURFACE 49½in. by 9⅞in.

ALL MODELS HAVE 15½in. CLEARANCE UNDER WHEEL

WRITE FOR FULL DETAILS TO DEPT. M13

- WHEEL PERIPHERAL SPEED CONSTANT
- AUTOMATIC SIZING WITHIN 0.0002in.
- NEW PATENTED WAYS GIVING ABSOLUTE RIGIDITY & PRECISION
- AUTOMATIC COMPENSATION FOR WHEEL WEAR THROUGH REDRESSING



CONTROL
SLIDE

GRINDING TIME PER PIECE 9 SECS.
ACCURACY OF FORM 0.0002in.
DEPTH OF PROFILE 0.03in.

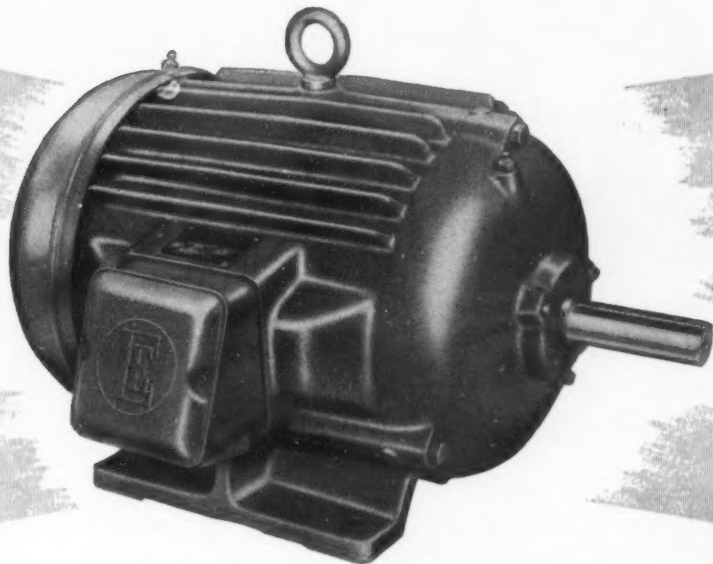
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BATTERSEA, LONDON, S W 11
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*Prices have been reduced for both
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The ENGLISH ELECTRIC Co. Ltd., Industrial Motor Works, Bradford

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The radial with the **NITRIDED-STEEL SPINDLE AND SLEEVE**

The **AMERICAN HOLE WIZARD**



European built

The construction of spindle assembly is an outstanding achievement. The spindle is made of nitrided steel for extreme surface hardness—lap-ground for utmost precision. Spindle sleeve is also of nitrided steel, honed to size and mounted in precision Timken roller bearings.

- Twelve speed head with built-in motor drive with motor mounted on head and directly coupled to initial driving shaft.
- Electric Column Clamp operated from head.
- Combined Elevating and Arm Clamping mechanism through single lever control.
- Electrical reverse for tapping.
- Six Geared Feeds.
- Three Optional ranges of 12 direct reading spindle speeds.
- Nitrided spindle and spindle sleeve—anti-friction mounted.
- Lo-Hung Spindle Drive.

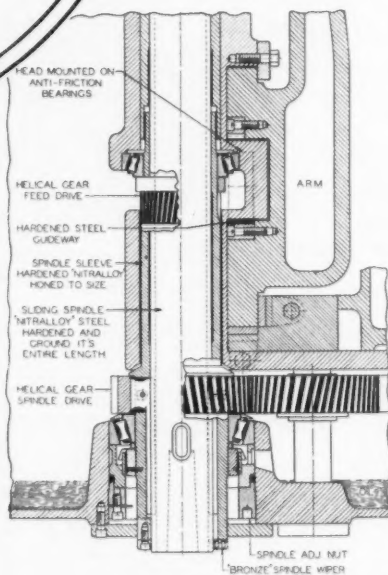


Diagram of spindle assembly.



Spindle unit showing integral feed rack, helical gear drive and adjustable Timken roller bearing mounting.

Sole Agents in the British Isles for American Tool Works.

BUCK & HICKMAN LIMITED

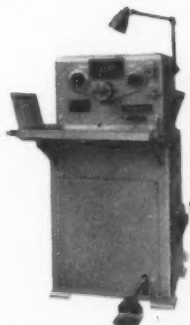
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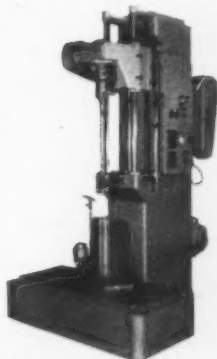
Automatic correction of taper, ovality and errors of surface finish, elimination of loss on scrap components and consistent accuracy of finish—these are only a few of the advantages that Delapena equipment offers. Give us a ring and we'll tell you anything you want to know, and give you the benefit of some sound advice on honing applied to YOUR particular needs. It will pay you to ask us about honing—we are the experts!

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for advice
on the equipment
you need**



Horizontal Honing Machines
for bores from .120" to .3125"
internal diameter and up
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Our customer produces Iron Pipe fittings. Normal tap life when machine tapping was only 40/50 components. A Technical Representative from Speedicut Works studied the problem and made recommendations on design and treatment which increased tap life on this operation to over 1,500 components.

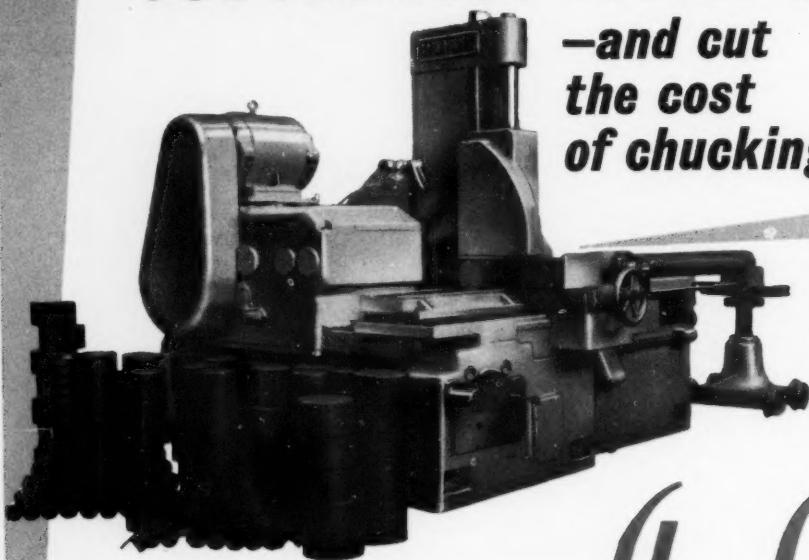
Take advantage of the latest techniques in tool making
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Specify

**SPEEDICUT
TOOLS**

USE THE 'SLUG' TECHNIQUE

**—and cut
the cost
of chucking work**



Photograph shows various size steel blanks cut in six hours. One operator can work more than one machine, once setting-up and loading are completed. The cycle is automatic and even the swarf is collected in a bin.

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AUTOMATIC COLD SAW

MODEL AL/CC

28in. Size with chip conveyor — parts slugs from bars in a fraction of the normal lathe or automatic time

Close control of production times has proved without doubt that the use of pre-cut slugs on single spindle bar automatic and turret lathes can show savings of from 30 to 75 per cent.

The new FLUIFEED automatic cold saw has been specially developed to give production shops the full advantage of the 'slugging' technique, and really revolutionary production

times are being recorded. We will gladly co-operate with you on your own work. Get in touch with us without delay.

FOUR SIZES OF THE 'FLUIFEED' AUTOMATIC

22in. ADMITS UP TO 7½in. DIAMETER.
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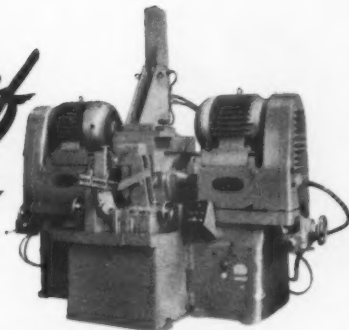
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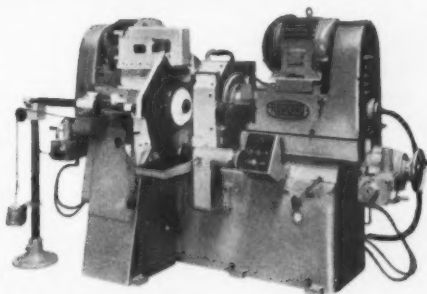
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* Illustrated here are but a few of the very many types of 'Duplex' surface grinding machines that we manufacture.



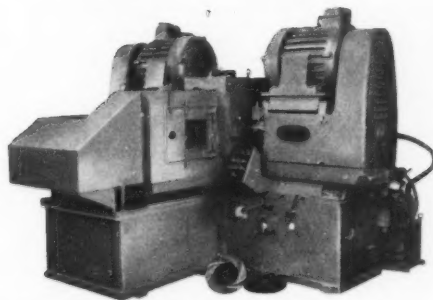
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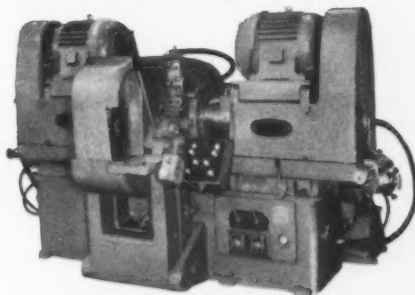
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* All machines are capable of extremely impressive rates of production, coupled with high degrees of accuracy and surface finish.
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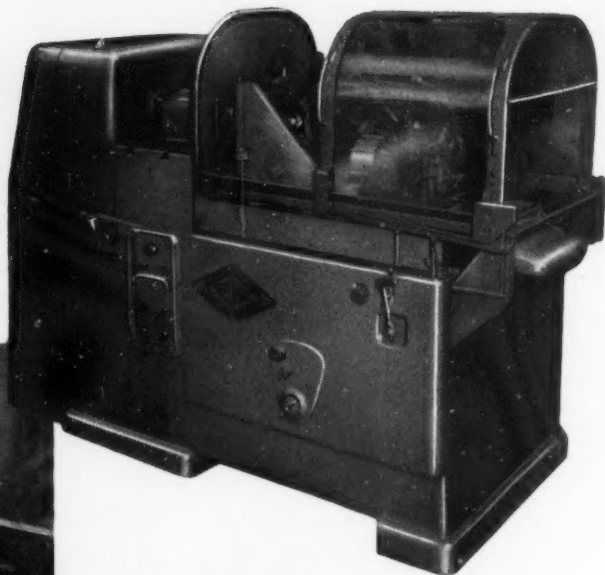
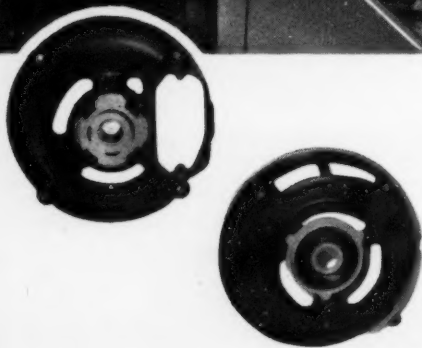
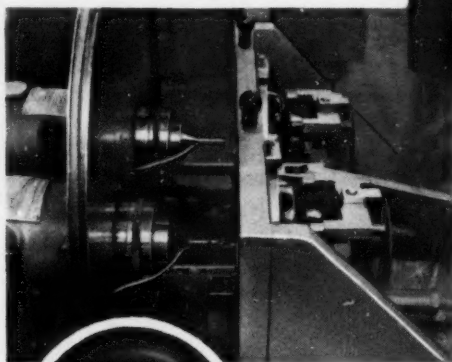
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On this two spindle PRECIMAX fine borer, end shields for fractional horse power motors are finish bored in a time cycle of only 30 seconds. The machine cycle is fully automatic and limits are maintained within 0.00015in.

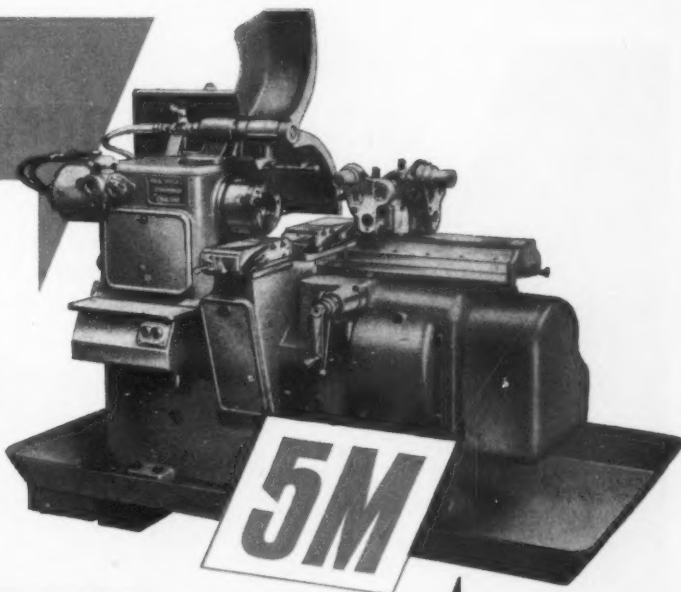


B.T.H. Ltd., who have eleven PRECIMAX fine boring machines in operation, are only one of a growing number of manufacturers who are finding that the precision, versatility and production efficiency of their machine means an improved product and lower costs all round. Ask us for complete details. Write today.

PRECIMAX
FINE BORING MACHINES
*for precise and maximum
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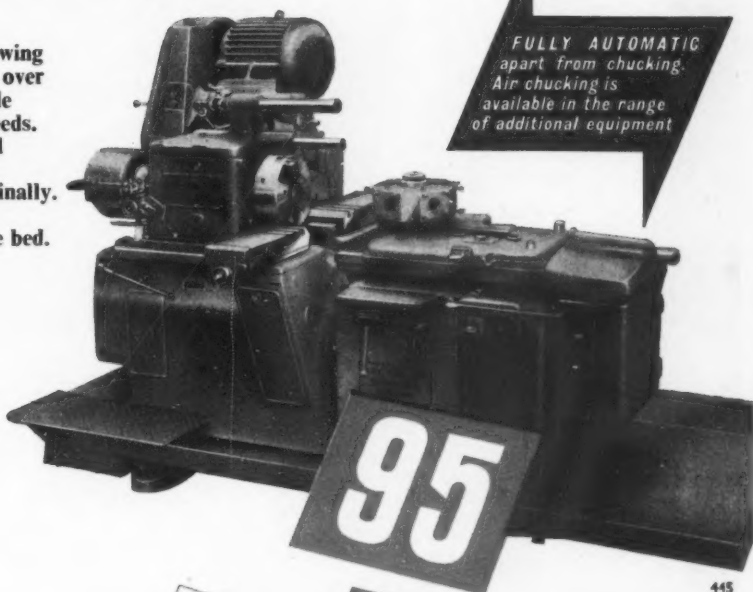
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5M Maximum swing $7\frac{1}{2}$ ". Swing over cross slides $6\frac{1}{2}$ ". Independent motors for spindle drive and rapid motion to turret and cross slides. Wide range of speeds with three automatic changes. Suitable for small batch work.

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FULLY AUTOMATIC apart from chucking. Air chucking is available in the range of additional equipment



	5M		95	
Maximum swing	ins $7\frac{1}{2}$	mm 197	ins $12\frac{1}{2}$	mm 317.5
Maximum swing over cross slides	ins $6\frac{1}{2}$	mm 168	ins $10\frac{1}{2}$	mm 273
Cross slides stroke	ins $2\frac{1}{2}$	mm 70	ins 4	mm 101.6
Cutting travel of turret	ins $4\frac{1}{2}$	mm 111	ins $5\frac{1}{2}$	mm 146
Number and range of spindle speeds	21 FORWARD 14 REVERSE 58 to 1458 r.p.m.		30 40 to 834 r.p.m. or 60 to 1220 r.p.m.	
Horse power of main motor	$4\frac{1}{2}$		10	

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BIRMINGHAM 33
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Cables: MADRICUT · BIRMINGHAM.

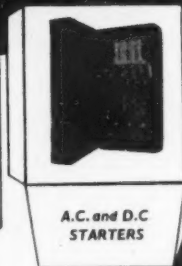
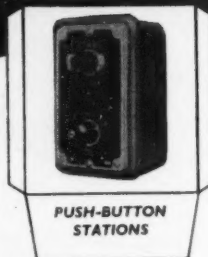
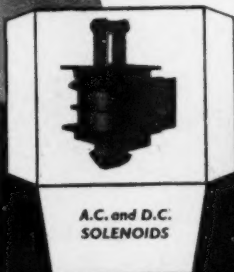
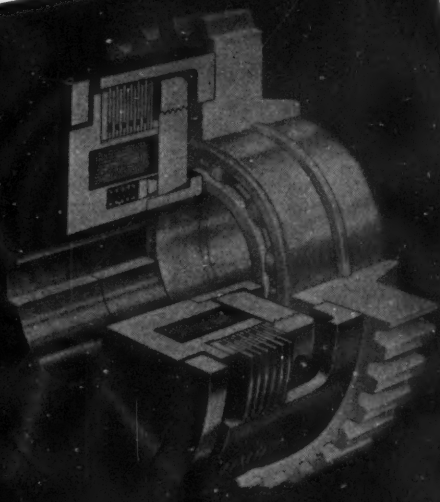
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Compact design — short time response — high thermal capacity — low idling torque. These are some of the outstanding features of this electro-magnetic multi-disc clutch.

May we send you full details of these clutches and information about other Igranic products for which packaging machinery designers are finding many applications?



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**WORLD'S FINEST COMPLETE
SPECIALISED SCREW SERVICE**



You never notice a screw
when it does its job.

When it doesn't, you wish you'd
specified Unbrako.

Make no mistake, you *can* always specify
Unbrako.

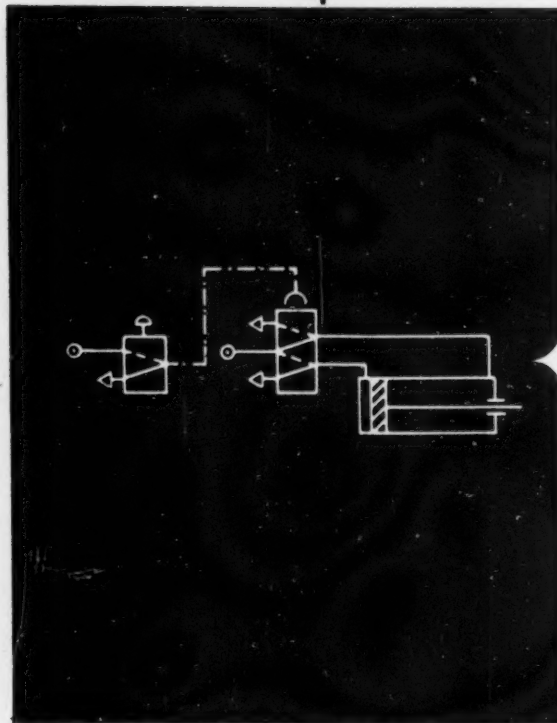
There is a huge standard range to choose from, but
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in B.A., B.S.W., B.S.F. metric and unified.

Unbrako technicians are fastener-minded. What's
more, they are enthusiastic and helpful people,
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the best screw that money can buy — a
screw you can fit and forget. Details
of sizes and threads will gladly be
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A single-pressure operated 5-port valve is used to operate the cylinder. With the valves in the position shown, mains air is connected to the front end of the cylinder and the piston rod is retracted.

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The Martonair Technical Service is freely at your disposal at all times. Fully qualified to advise on all aspects of applied pneumatics, the Service is backed by a staff of technical representatives throughout Great Britain, and by overseas offices and manufacturing companies.

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PARKSHOT • RICHMOND • SURREY • ENGLAND

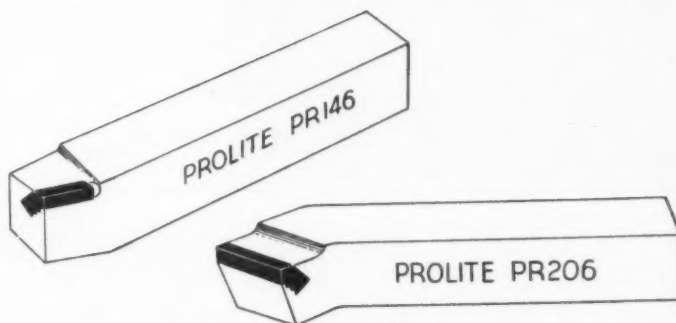
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MANUFACTURERS OF PNEUMATIC HOISTS • CYLINDERS • CONTROL VALVES AND ACCESSORIES

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SERRATED TIP TOOLS



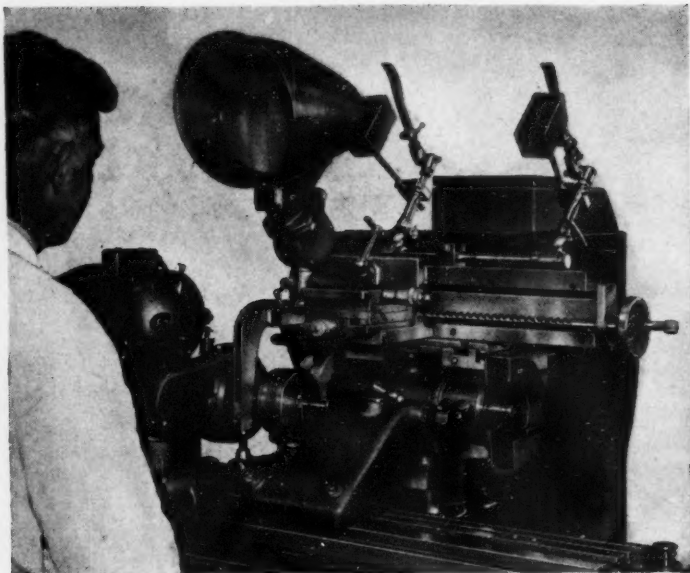
The tip is held securely in the shank by a series of carefully designed serrations, which eliminate any movement between tip and shank, thus ensuring freedom from vibration.

Standard turning tools in a wide range of sizes from $\frac{1}{2}$ in. square section are being produced in shapes required for the more popular machining operations.

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Specially designed for producing cylindrical formed work, or work pieces having awkward contours, or those requiring angular faces on lengthy jobs, in fact, to cover the more difficult of the toolroom tasks in cylindrical grinding.

JONES — SHIPMAN

high precision circular form-tool grinding machine having jig boring control arrangement

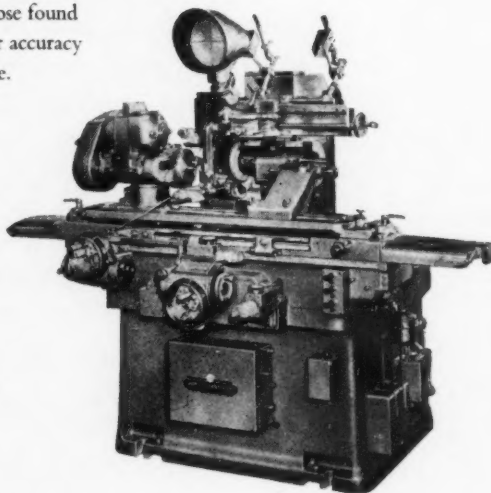
The easily settable controls are equivalent to those found on the normal Jig Borer, thus providing greater accuracy than previously possible on this type of machine.

other prominent features . .

Three rates of speed control to cross-feed and table traverse.
Gauge bar and micrometer settings to 0.0001 in.
Table and cross-saddle mounted on anti-friction slideways.
Wheelhead spindle centred on the centre line of vertical swivel.

additional equipment includes . .

Pantographic wheel truing arrangement
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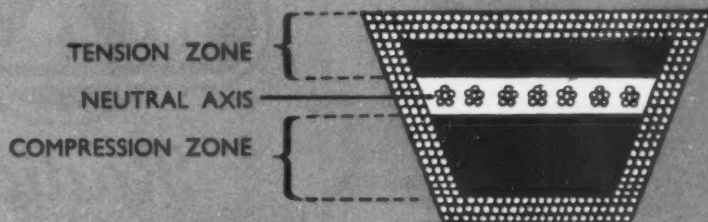
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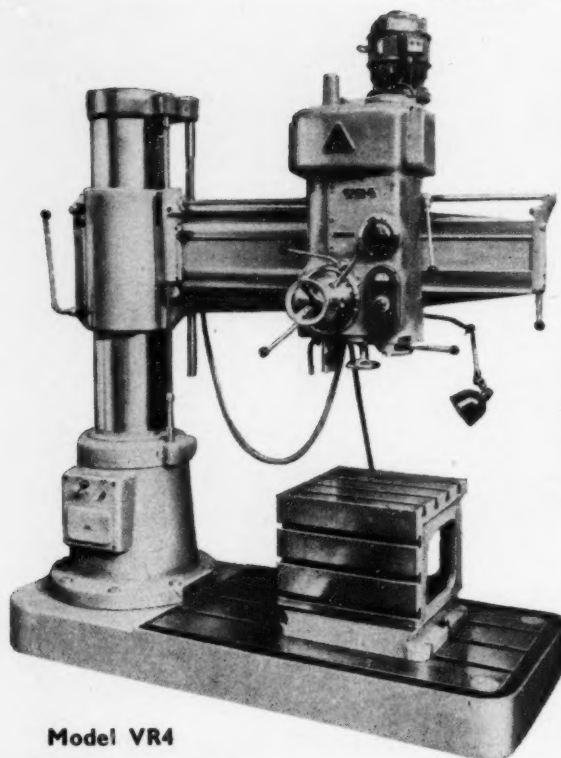
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IMMEDIATE DELIVERY
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Radial **DRILLING MACHINES**

Consider these features :

- ★ Simplified and easy operation.
- ★ Patent locking of arm on column.
- ★ Single lever locks arm and head.
- ★ Drilling speeds selected and engaged by single lever.
- ★ Automatic disengagement of power feed at required depth.
- ★ Automatic lubrication of drilling head.

SPECIFICATION	VR2	VR4	VR6	VR8
Drilling Capacity in Steel	1in.	1½in.	2in.	3in.
Drilling Capacity in Cast Iron	1½in.	2in.	3in.	4½in.
Maximum distance centre line of spindle to column	31½in.	49in.	79in.	99 in.
Minimum distance centre line of spindle to column	9in.	12½in.	17in.	19½in.
Maximum distance spindle nose to Box table	24in.	30in.	52in.	64in.
Maximum distance spindle nose to base	40in.	51in.	72in.	83in.
Vertical movement of arm on column	21in.	28in.	34in.	41½in.
Taper in spindle	3 M.T.	4 M.T.	5 M.T.	6 M.T.
Spindle Speeds (12)	90-4,500	45-2,000	16-1,400	11-1,000
Spindle Feeds	(6)	(10)	(10)	(10)
	85-850	16-1,020	13-820	11½-720
	cuts p. inch	cuts p. inch	cuts p. inch	cuts p. inch

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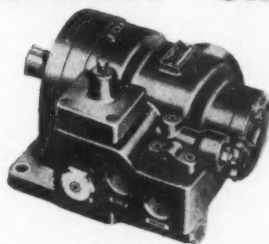


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Low pressure type
reducing valve.*

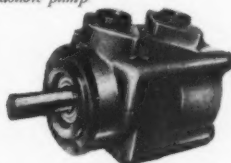
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The fully automatic operations, now tending to dominate industry more and more, call for a degree of reliability and flexibility which are completely satisfied by specifying British-made **VICKERS-DETROIT** Oil Hydraulic equipment.

S A V Hydraulics offer

- Precision equipment renowned for reliability and low cost.
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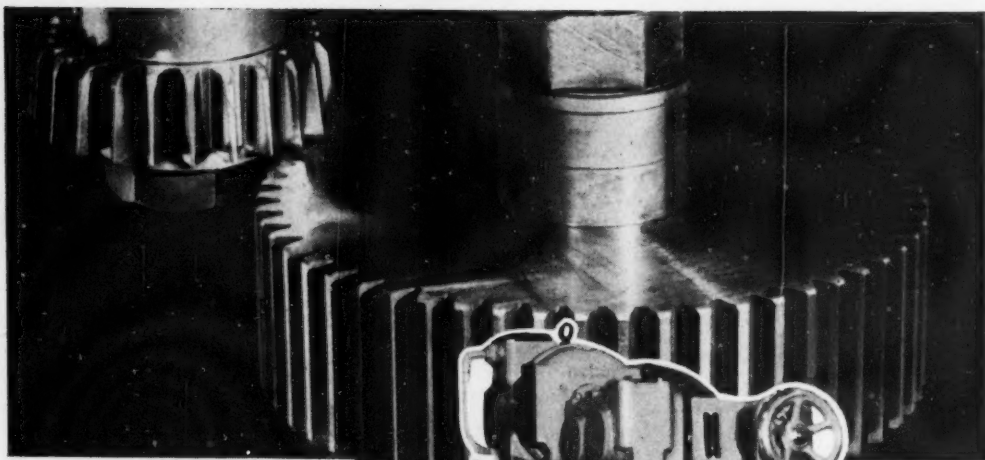
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OIL HYDRAULICS

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YOURS PRECISELY...

W. E. Sykes Ltd.—specialists for more than 30 years in the design and manufacture of machines and tools for gear production—invite a closer look at the model V10A gear shaper. External and internal spur gears, helicals, sprockets, serrations, racks, ratchets and many intricate profiles can be produced by this versatile machine.

The precision model V10A will generate with extreme accuracy gears up to 8 inches in diameter and from 12 to 64 D.P. Tooth to tooth and total composite errors are guaranteed to be within the Admiralty Class 1 specification 'Precision Gearing for Control Systems'. Full details and descriptive literature are freely available, together with the experience of the Sykes Technical Advisory Service.



PRECISION GEAR SHAPERS

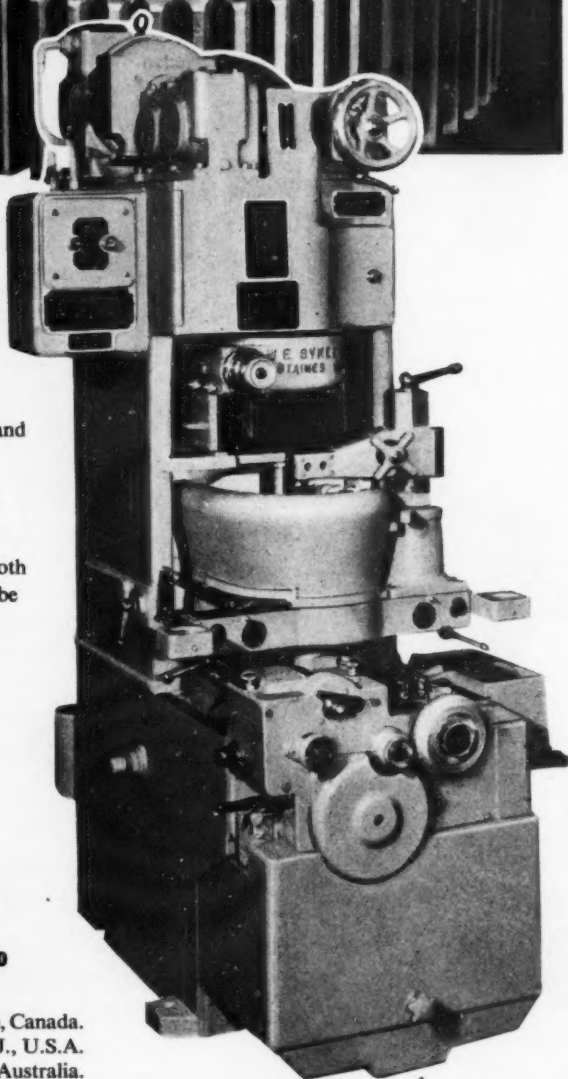
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WHAT IT IS

DOUBLE BOND, evolved after extensive research by the makers of Hermetal, is manufactured from chemically reactive resins (Epoxy based) forming a new, self-setting, spreadable compound which entirely supersedes metal fillers—including lead.

As part of the new technique in the fabrication of equipment with resin bonded glass laminates, it provides the joint and seal.

PROPERTIES

- Exceptional adhesion
- Great tensile strength
- Chemically resistant
- Sets harder than lead
- Self-curing to any depth
- Non-shrinking
- Easily workable
- Extended "pot" life
- Replaces leading—no lead poisoning, non-injurious

COULD YOU BE USING IT?

"Double Bond" has a wide range of production and trade applications; practically every industry can benefit from the saving in time and costs which its use ensures.

DOUBLE BOND mends, seals and fills cracks, blow-holes, rivet heads, joints, even large cavities—in one application.

For construction of assembly and drilling fixtures, jigs, patterns, work or tool holders. Instead of lead or solder for sealing joints, filling damaged parts, coachwork production and repairs, etc.

In place of metal for cast and/or machined components of prototype or quantity produced equipment.

For avoiding delay in delivery of "specialist" equipment. Fabricate it with plywood or plastic bonded sheet, etc., and joint and protect it with "Double Bond."

TWO TYPES!

PUTTY can be mixed and moulded with the hands or mechanically. CREAM-mixed and applied with a knife or spatula.

Write for descriptive folder or:

TRIAL SUPPLY

4 oz. each of putty and cream with full directions for use.

7/6 post free

Ministry approval D.T.D. 900/4572.

Available in standard packs of 1 lb., 3 lb., 7 lb. and upwards.

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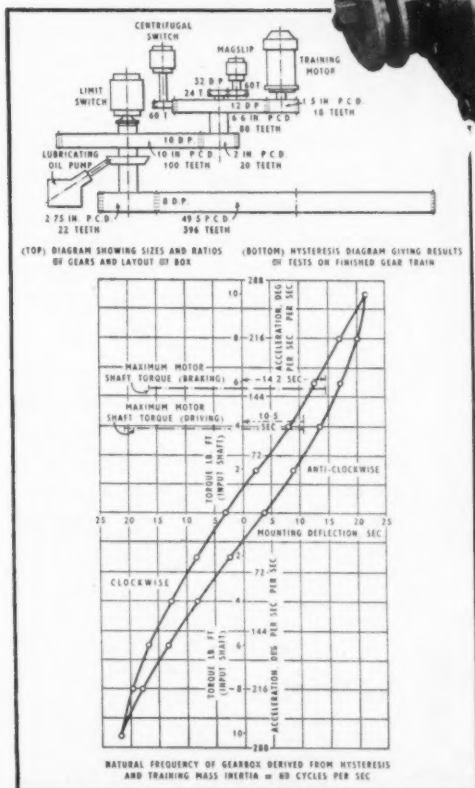
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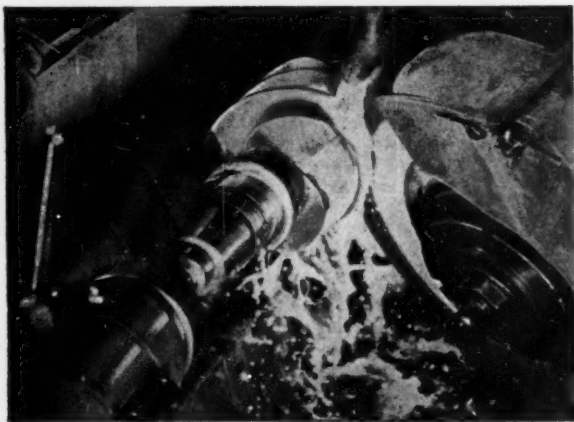
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Abstracts of Principal Articles

The Production of Calculating and Ticket-issuing MachinesP. 232

Parts for the calculating and ticket-issuing machines built by the Bell Punch Co., Ltd., Uxbridge, Middlesex, are made in batches, the quantity in each batch ranging from a few components to several thousand. Routing on a Wadkin machine is employed for certain operations on cases for calculating and adding machines, and 20 to 30 different types are machined in this way. For drilling the base fixing holes in cases for Plus adding machines, the company have developed a jig with hydraulic clamping, which is used on a Pollard machine with an adjustable multi-spindle head. Cases of three different lengths can be accommodated. There is a large automatics section at the Uxbridge works, and a set-up on a B.S.A. 48 machine provides for milling a flat on a small aluminium-alloy carry-over pin. For the second series of operations on hinge spindles, a C.V.A. No. 8 automatic is arranged for magazine feeding. Spacers are produced on automatics, but to ensure that they are of the correct length and that their end faces are parallel, and square with their axes, they are finished to length by straddle milling, on a specially-equipped machine. Another milling machine is tooled-up to provide for rolling male characters on steel or aluminium discs. The company's heat treatment department has a throughput of 53,000 parts per week, and among the equipment installed is a Radyne induction-heating unit with electro-magnetic arrangements for holding gears, which are automatically released into the quench tank at the end of the heating cycle. To ensure the necessary quality standards, there is a large inspection bay, and among the workers employed is a blind inspector who uses a Sigma audible comparator. (MACHINERY, 93—30/7/58.)

Developments in Precision Boring...P. 243

In a paper by Mr. C. L. David, Dipl.-Ing., which was presented at the conference on Technology of Engineering Manufacture organized by the Institution of Mechanical Engineers, the purpose and applications of precision boring are first briefly discussed. Attention is then directed to various aspects of the process including work clamping without distortion; the effect of cutting forces; the need for accurate slide movement; work-holding fixture design; carbide tools and boring bars; methods of preventing vibration and chatter including built-in damping arrangements; automatic balancing for boring bars which run at high speeds; disposal of swarf; provision for accurate tool adjustment; multiple spindle set-ups; automatic loading devices; and the relative advantages of hydraulic and cam operation. Reference is also made to gun drilling, whereby the roughing and finishing operations normally required for accurate holes can be combined. (MACHINERY, 93—30/7/58.)

Machine Tool Alignment Recorder...P. 251

The instrument here described has been developed by the Mechanical Engineering Research Laboratory

for recording, continuously, the errors in alignment of the hob saddle motion of gear hobbing machines. On large vertical machines difficulties were experienced in obtaining reliable results when a ground cylindrical test pillar was used for this purpose. With the new instrument the errors are recorded, by a photo-electric gauging unit, in relation to a freely suspended vertical reference wire. If the table axis of the machine is not truly vertical, compensation may be made by means of a sine-arm corrector bar which is moved in synchronism with the hob saddle traverse under mag slip control. The measuring head is described in detail and performance is discussed from the standpoints of sensitivity and linearity, stability, conditions of vibration, and other sources of error. It is pointed out that the equipment, although developed for gear hobbing machines, can be employed effectively for carrying out alignment measurements on other types of vertical machine tools. (MACHINERY, 93—30/7/58.)

Contract Pressure Die Casting at the Works of Fonderpress, Bologna.....P. 269

This article describes some of the plant and methods employed for the production of pressure die castings, on a contract basis, at the works of Fonderpress Di Gamberini Tagliavini & Co., Bologna, Italy. Here, Triulzi water-hydraulic machines in sizes capable of exerting die closing forces up to 1,000 tons are installed, and many interesting castings are produced. These castings include a range of components for the Lambretta motor scooters made by the Milan firm of Innocenti, S.p.A., several of which are described and illustrated. The combined crank- and transmission case for the latest design of Lambretta scooter is pressure die cast in aluminium and has a trimmed weight of 15½ lb. This casting is of extremely intricate design, the ribs and other projections on the outside being formed by four moving core-blocks on the die face, arranged at approximately 90 deg. The cover casting weighs 4 lb. but is of much more simple design. Other Lambretta castings discussed include the front casing, the handle-bars, which incorporate steel tube inserts and are produced in a die with several interesting features, and a transmission case for a smaller engine unit. A die for the production of a photographic enlarger base in aluminium alloy is also described and illustrated. (MACHINERY, 93—30/7/58.)

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

Cleanliness in Manufacture

For various reasons, increasing attention is now properly being paid to cleanliness at all stages in the manufacture of many metal parts and it is evident that as specifications for performance of completed assemblies become more and more exacting, this tendency must necessarily be accentuated. Apart from contamination caused by the atmosphere in industrial areas, which may be expected to be lessened substantially as a result of measures that are now being taken, the formation or dissemination of foreign matter is inseparable from many production processes. Consequently, many factories may rapidly become exceedingly dirty unless cleaning is carried out systematically. General dirtiness is obviously undesirable from the standpoint of the health of those employed and the psychological effects are detrimental to efficiency. In addition, such conditions are unfavourable for the operation of expensive machinery, and the standards of both natural and artificial lighting are speedily affected. Equipment is now available whereby the regular removal of dirt from floors and walls, for example, is greatly facilitated, and it is important that such equipment should be widely applied.

Where general air conditioning of factory buildings is not practicable, much may be accomplished by the provision of effective exhaust systems to carry away foreign matter, which might otherwise become airborne, from the points where it is formed. Such arrangements are particularly important where the dust produced is especially detrimental to health, but their installation may also be fully justified in many other instances by reason of the reduction in general contamination that may be achieved.

Increasing care is being taken to provide protection for vital surfaces of precision machines by enclosure or the use of wipers, in order to exclude dirt and thus reduce wear. Where work of high accuracy is demanded, however, such precautions should be regarded as a second line of defence, and particular care should be taken to reduce the deposition of dust, especially if the particles are of an abrasive nature. Apart from the original accuracy and condition of machines, the results obtained at many operations depend upon correct location of parts in jigs or fixtures. Careful removal of swarf or other contaminant from location surfaces is therefore often essential, and may

sometimes be conveniently accomplished by automatically flushing a fixture with coolant prior to re-loading, by the application of a timed air blast, or by passing the fixture through a washing installation. The latter arrangement can be conveniently adopted where the fixtures are returned on a conveyor to the loading end of a transfer machine.

Cleaning of the workpiece both before and during the machining sequence may be equally essential and there is an increasing choice of equipment and methods for thorough and economical treatment. It may, for example, be particularly important to ensure that adhering inclusions are removed from the interiors of cored castings, to prevent the possibility of subsequent detachment in service, and processes are now available whereby this otherwise difficult operation can be consistently performed. Inter-operation cleaning is also becoming increasingly common, to ensure that contamination from one stage of a manufacturing sequence is not carried over to the next. Equipment for this purpose can be completely mechanized so that the cost of treatment is slight in relation to the benefits achieved. Dirt removal before and during machining contributes to the final accuracy and finish of the product and the higher the standard demanded, the more effective must be the precautions. Where a very high quality of finish is specified, for example, thorough filtration of the coolant employed at the final grinding stages may be necessary.

Although foreign matter on workpieces during manufacture may be undesirable, however, its presence in the final assemblies may be much more detrimental, because it may speedily destroy the accuracy which has been so painstakingly achieved, or may affect essential sensitivity of movement. It follows that final cleansing of parts and the conditions under which assembly is carried out may be of particular significance. In these fields, too, there have been important advances, among which may be mentioned the introduction of ultrasonic cleaning techniques whereby very effective removal of dirt particles is ensured. When this method is employed in conjunction with a suitable fluid, a very high standard of cleanliness for small and intricate parts can be ensured. Even so, where the minimum of final contamination is sought it may be necessary to have some reliable means of

(Continued on page 282)

The Production of Calculating and Ticket-issuing Machines



**Methods and Equipment Developed by
the Bell Punch Co., Ltd., For the Batch
Manufacture of a Wide Variety of
Precision Components**

In the preceding articles in this series* devoted to the activities of the Bell Punch Co., Ltd., The Island, Uxbridge, Middlesex, details have been given of some of the more interesting press tools and other equipment that have been developed for the production of components for adding and calculating machines, totalisator equipment, ticket-issuing machines of various types, and aircraft instruments. Attention was drawn to the importance which the company attaches to the quality of finish on many of these parts, and some of the methods employed for achieving the required high standards were described. Reference was made to shaving on power presses, profile engraving, and grinding with diamond- or crush-formed wheels, or with the aid of special generating equipment. It was pointed out that the company has installed an extensive variety of machine tools at their Uxbridge works, and that, in order to produce components in the most effective manner, certain of the machines are employed in a somewhat unorthodox way. The components produced are of many different types, and some are required in very substantial quantities, whereas others are needed only in small numbers. Some further machining, metal-forming and treatment operations are here considered.

Production of Sumlock calculating machines forms an important part of the company's activities, and there are three types of these machines which are produced in large numbers. The Sumlock Figureflow machine is manually-operated,

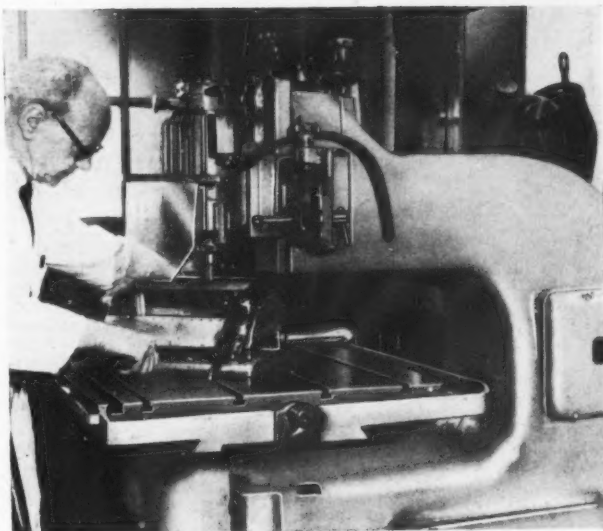
and provides for addition, subtraction, multiplication, and division. A similar electrically-powered machine is designated the Unielectric, and a type with a second set of answer dials, to provide for accumulation and direct subtraction, is known as the Duoelectric.

Cases for these machines are gravity die cast in LM20-M aluminium alloy, and the keyplate aperture in the top is machined at an early stage in the manufacturing sequence. This operation is carried out on a Wadkin L.U.295 router, much more rapidly than would be possible by orthodox milling. The Wadkin machine is housed in a large glass-panelled cubicle, at one end of the machine-shop, in order to reduce the transmission of noise caused by the routing operation, and to prevent the scattering of swarf. This machine is used for operations on workpieces made from aluminium alloys, brass, plastics and wood, and serves to supplement the resources of the milling section of the main machine-shop, to which reference was made in an earlier article.

Between 20 and 30 different types of cases and housings are machined by routing, and the set-up for performing this operation on the keyplate aperture of a Sumlock Figureflow case is shown in Fig. 1. The aperture is routed on three sides, and the edge face at the front is finished by milling on a vertical machine. Prior to these operations, internal lugs at the corners of the casting are machined on the Wadkin router, and a hole is drilled in each lug, which is subsequently tapped to receive a base-securing screw.

* MACHINERY, 92/1192-23/5/58 : 92/1492-27/6/58, and 93/60-9/7/58.

Fig. 1. A Wadkin L.U.295 Machine is Employed for Routing the Keyplate Apertures of Sumlock Figureflow Calculating Machine Cases. Routing is Employed for Machining between 20 and 30 Different Cases, also for Work-pieces Made from Aluminium Alloys, Brass, Plastics, and Wood



For routing the keyplate aperture, the case casting is clamped in a fixture, which is typical of those employed on the Wadkin machine. Four blocks are secured to the light-alloy fixture base-plate, and the machined faces of the lugs in the casting rest on these blocks, with pins that project upwards from the blocks engaging the drilled holes. When the casting is located and supported in this manner, it is inclined so that the side-edges of the cutter teeth produce the required angle on the rear edge-face of the aperture. Pairs of toggle-clamps at the front and rear of the fixture are applied to secure the casting on the support

blocks. A guide-plate, screwed and dowelled to the under-side of the baseplate, has an opening of a shape that corresponds to the aperture, and there are four wooden handles projecting from brackets on top of the baseplate. With the aid of these handles, the operator moves the fixture so that the edges of the opening in the guide-plate engage a follower-pin projecting upwards from the machine table. This pin is of the same diameter as the routing cutter—in this instance, $\frac{1}{8}$ in. The cutter, supplied by Wadkin, Ltd., has two tungsten-carbide-tipped teeth, and is run at 18,000 r.p.m. The time for the routing operation is $1\frac{1}{2}$ min.

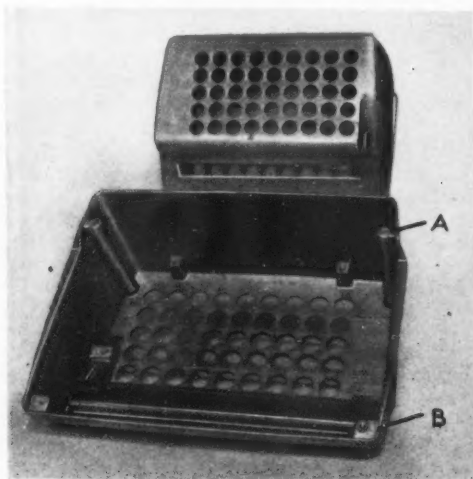


Fig. 2. Two Aluminium-alloy Die Cast Cases for the Improved Plus Adding Machine. Cases for the Different Types of Plus Machine may have 12, 9 or 6 Rows of Holes, which are Produced by Cores in the Die. Internal Lugs in Each Case are Drilled and Tapped for the Base Fixing Screws

DRILL JIG WITH HYDRAULIC CLAMPING

Improved versions of their well-known Plus manually-operated adding machines have recently been put into production by the company, and one of these new machines is shown in the heading illustration. The machines are made in a number of different designs—for example, 12-column decimal currency, 9-column sterling, 9-column weight, and 6-column time—the cases shown being for a sterling machine. These cases are pressure die cast in LM6-M aluminium alloy, and they incorporate cored holes, for the passage of the plastics key-tops, which are of circular cross-section. The holes are arranged in parallel rows, from front to rear, and the number of rows of holes in each case corresponds to the number of columns in the type designation of the machine to which it is fitted. The cases for sterling and certain other

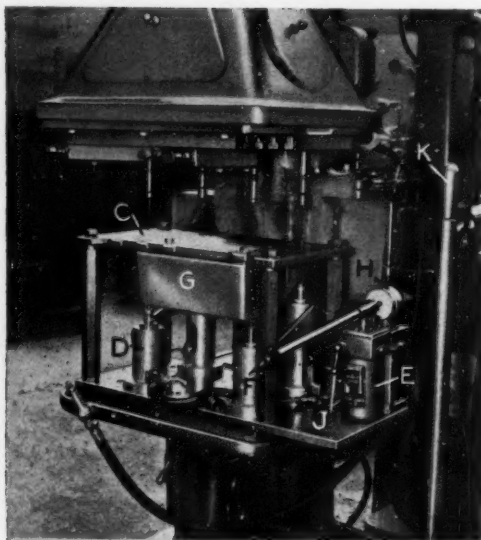


Fig. 3. The Base Fixing Holes are Drilled in Plus Adding Machine Cases at this Set-up on a Corona 12 M.X.T. Machine. The Fixture Incorporates Hydraulic Jacks for Clamping the Work-piece, Pressure-fluid Being Supplied by the Lever-operated Pump at the Right

machines require reduced numbers of holes, and, therefore, a number of retractable cores are provided, which can be withdrawn without removing the die from the casting machine.

In Fig. 2, the case in the foreground has been inverted so that details of the interior may be observed. The cored holes for the key-tops may clearly be seen, and each hole is held within 0.003 in. of the specified position. Die castings are supplied by Orb Engineering Works, Ltd., Middleton Junction, Manchester, who designed and built the dies. Each case casting incorporates lugs, as indicated at A and B, in which holes are drilled 0.116 in. diameter (No. 32 drill), and later tapped 4 B.A. At the assembly stage, these holes receive the screws which secure the baseplate (or tray) to the case.

The set-up for drilling the holes on a Corona (Fredk. Pollard & Co., Ltd.) 12 M.X.T. pillar-type machine is shown in Fig. 3. Due to the different numbers of rows of holes, the case castings are made in three lengths, and the fixture fitted to the machine table is arranged to accommodate all three sizes. The fixture has a base made from

steel plate, and there are four vertical pillars which carry a bush-plate C. Mounted on the baseplate are four hydraulic ram units, as indicated at D, which are connected to a manually-operated pump E. The ram units and the pump were supplied by Power Jacks, Ltd., 353 Uxbridge Road, London, W.3.

By moving the lever F up and down, pressure oil is delivered to the rams, the piston rods of which are thus raised to clamp the case casting G against the location members on the underside of the bush-plate C. To ensure that a constant clamping force is applied, pumping is continued until the gauge H registers a value of 500 lb. per sq. in. Clamping pressure is maintained by a non-return valve, and the casting is released by re-setting the small lever J, which re-positions the valve and allows oil to flow back to the built-in reservoir unit.

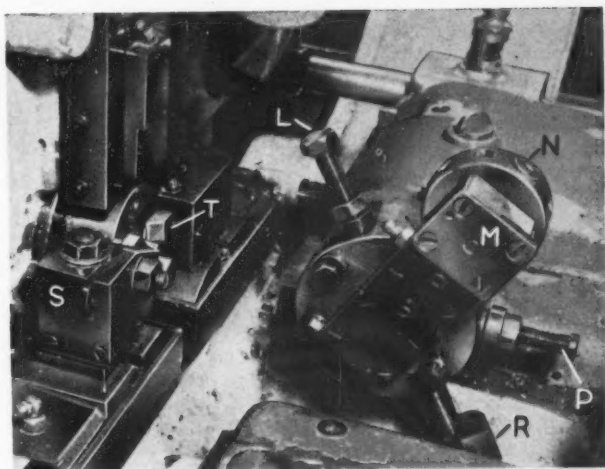
When the casting is loaded, it is initially located by members secured to the under-side of the bush-plate, which engage the interior of the case at the corners. Finally, the case is located by one cylindrical and one diamond-section pin, which engage two of the cored holes, and is thrust upwards by the rams until internal bosses engage pads beneath the bush plate.

It will be observed that there are two long and two short ram units to compensate for the curved form of the case. The pair of units—one long and one short—at the right-hand end is fixed in position, but the other pair may be mounted in any one of three settings, to provide for the different case-lengths. This adjustable pair of rams is connected to the pump unit by flexible piping. The location members at one end can be repositioned also, and the machine is fitted with a multi-spindle drill head of the adjustable-centre type. The head is fixed in position, and, for drilling, the table, jig and work are raised by moving the lever K. With this equipment, the floor-to-floor time for drilling one case is 45 sec.

MILLING A FLAT ON AN AUTOMATIC

The main machine shop at the Uxbridge works incorporates a well-equipped automatics section, in which there are large numbers of turret-type machines built by Brown & Sharpe, C.V.A., and B.S.A., also a battery of Swiss-type machines, including $\frac{7}{8}$ -in. Wickman units. Generally, the set-ups on these machines are straightforward, and provide for making such members as pins, bushes, hubs, wheels and circular blanks, on which further operations are performed elsewhere in the works. A component known as a carry-over pin, which forms part of the mechanism for an adding

Fig. 4. This Set-up on a B.S.A. 48 Single-spindle Automatic Provides for Milling a Flat on the Small Light-alloy Workpiece, Known as a Carry-over Pin. A Special B.S.A. Turret-mounted Attachment is Used, and the Cycle of Operations is Completed in 12 sec.



machine, has a flat milled at one end, during the operation cycle on the B.S.A. 48 automatic, with the aid of an attachment made by the machine builders.

A close-up view of the set-up on the B.S.A. machine is given in Fig. 4. Carry-over pins are made from light-alloy bar, of $\frac{1}{8}$ in. diameter, and each is $\frac{1}{8}$ in. long. The bar is held in a collet chuck, and is run at 3,685 r.p.m. At the first stage in the operation cycle, the bar is fed to an adjustable turret-mounted stop *L*. Then, the machine spindle is stopped, by engaging the spindle change-speed clutch with one of the drive sprockets, which is held stationary by means of a brake unit. Next, the milling head *M*, at the adjacent turret position, is advanced, and the end of the bar of work-material is engaged by a bush *N* in the cutter housing.

This bush serves to steady the end of the bar, while the flat is being milled by a 0.063-in. thick, high-speed steel saw, of $1\frac{1}{2}$ in. diameter. The saw is mounted on an arbor which is driven by gears from a shaft that passes through the tubular turret shank. Drive is transmitted to this shaft, from standard high-speed drilling equipment at the rear of the machine, by bevel gearing. The flat produced is located on the axis of the workpiece, and is $\frac{1}{8}$ in. long.

When the milling attachment has been withdrawn, the turret is indexed to bring the second adjustable stop *P* into position, the bar is advanced to contact this stop, and the spindle clutch is re-engaged with the driving sprocket. Two stops, and two feeding operations, are employed so that only a short, rigid piece of bar projects from the collet for the milling operation. At the next stage, the bar is turned to 0.090/0.093 in. diameter by a high-speed steel bit in the box tool *R*. The end of the workpiece nearest to the collet is reduced to 0.061/0.063 in. diameter by a circular form tool mounted in the holder *S* on the front cross-

slide, and, finally, the workpiece is parted-off by a square-shank tool *T* on the rear cross-slide. The cycle of operations is completed in 12 sec.

MAGAZINE FEEDING HINGE SPINDLES

Fig. 5 shows the set-up on a C.V.A. No. 8 automatic for the second cycle of operations in the production of hinge spindles. These spindles are produced from carbon-steel bar on an adjacent C.V.A. machine, on which the bar is centred and drilled at one end, before it is fed to a stop and parted-off. The drilled hole provides a tubular end for subsequent riveting, and a similar hole is necessary at the opposite end.

Workpieces from the first machine are loaded into a chute-type magazine *U* on the second automatic. To facilitate loading, there is a horizontal platform at the upper end of the chute, with guide plates at the sides to align the parts with the shallow groove in the chute. Workpieces are retained in the sloping chute by two keeper strips, and between these strips there is a narrow gap so that the stock of parts in the chute may be observed, and parts may be removed in the event of jamming. Hinge spindles may be of three lengths—namely, $1\frac{1}{2}$, $1\frac{1}{4}$ and $1\frac{1}{8}$ in.—and three interchangeable chutes are provided, that for $1\frac{1}{2}$ -in. long spindles being shown. Each chute is machined to a dovetail form at the lower end, as indicated at *V*, whereby it is clamped in the associated mounting bracket. In addition to allowing the chutes to be interchanged, this method of mounting permits them to be adjusted for position vertically. The mounting bracket is pivoted on a support *W*, which

is bolted to the normal facing on the machine for the slotting attachment. Movement of the bracket (and the chute) in the vertical plane is restricted by the length of the curved slots for the bolts that secure it to the support W, but is sufficient to provide the necessary adjustment for the chute towards and away from the collet of the machine. To permit adjustment of the whole unit parallel to the machine spindle, slots are provided for the fixing bolts in the support W.

When correctly set, the end of the chute is just clear of the upper face of the transfer unit X on the front cross-slide. In this instance, it may be noted, a double-movement cross-slide is not used, since the normal slide-travel is of adequate length. The transfer unit is of L-shape, and one arm of the L-form projects beyond the end of the slide. Pivotaly-mounted on this arm is a carrier which is spring-loaded upwards, and it has two arms in which there are V-grooves. The ends of these arms may be seen at Y. With the front cross-slide withdrawn, the V-grooves in the arms are located beneath the end of the chute U, and receive the lowermost workpiece in the stack in the magazine. As the cross-slide is advanced, the

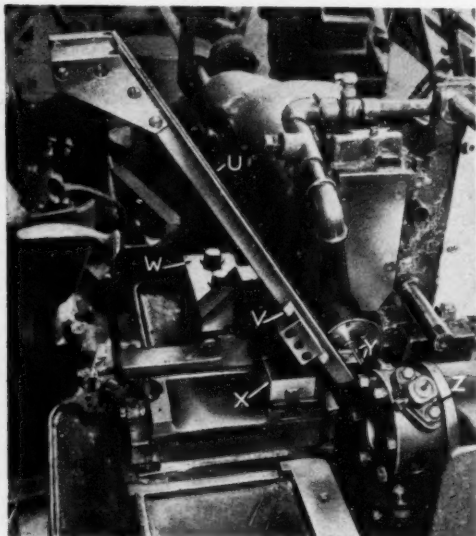


Fig. 5. Hinge Pins are Machined in Two Stages on C.V.A. No. 8 Automatics. Partly-machined Workpieces from the First Automatic are Loaded into a Magazine Unit on the Second Machine, Here Shown. One Piece at a Time is Carried to a Position in Line with the Spindle by a Special Holder on the Front Slide

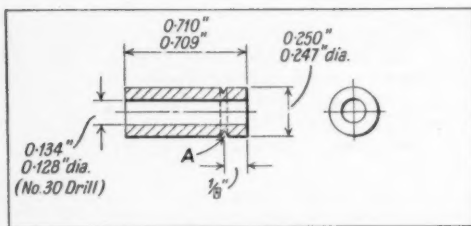


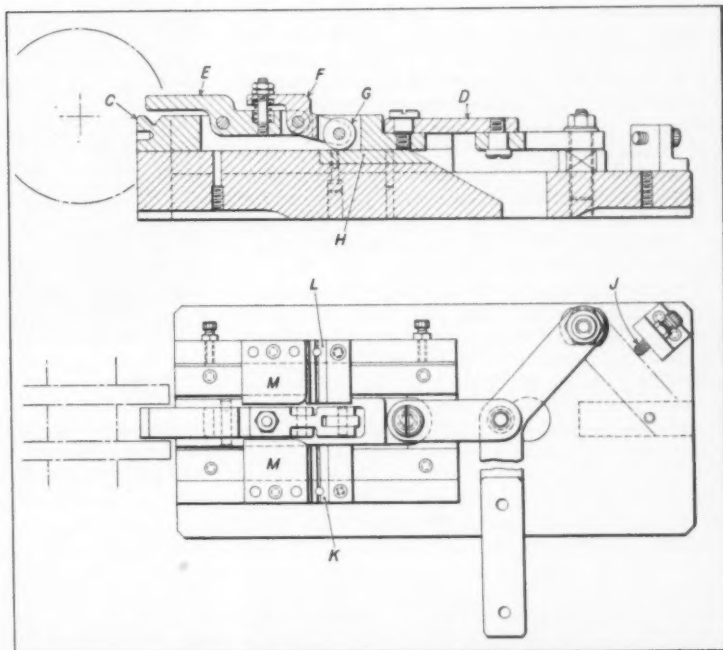
Fig. 6. Tubular Spacers, of the Design Here Shown, are Fitted Between the Frame Plates of Sumlock Calculating Machines. The Ends must be Machined after Plating to the Length Indicated, and the Machined Faces must be Parallel. An Identification Groove is Provided to Distinguish Plated Steel Spacers from Similar Light-alloy Components

workpiece is carried to a position in line with the machine spindle, and the next piece in the chute rests on the top of the body of the transfer unit, so that the stack in the magazine is supported. The workpiece in the carrier is pushed into the



Fig. 7. This Set-up on an Adcock & Shipley OD2 Machine Provides for Milling the Ends of Spacers, at a Rate of 550 per Hour. The Workpieces are Loaded by Hand, but are Clamped Automatically as They are Carried Towards the Cutter by Moving Jaws and Each is Ejected as the Next Workpiece is Loaded

Fig. 8. Sectional and Plan Views of the Fixture for Straddle Milling Spacers. During Milling, Each Spacer Rests in the V-groove in a Lever-actuated Slide, and is Clamped by an Arm which is Tilted as a Roller at One End Rides up a Sloping Surface on the Fixture Base



collet of the machine by a thrust member mounted in an adjustable holder in the turret. The length of the workpiece, and the width of the carrier, are such that the end of the workpiece enters the collet before the thrust member passes over the carrier arms, which it depresses against spring pressure.

With the workpiece inserted, the collet is closed, and the turret and cross-slide are withdrawn. As the cross-slide approaches the limit of its withdrawal movement, the V-grooves in the carrier arms are aligned with the chute, and the lowermost workpiece drops into them in readiness for the next cycle.

On this machine, the spindle is run at 2,670 r.p.m. The end of the workpiece is centred with a stub drill in the holder Z, the size of the centre produced being such that the hole that is drilled at the next stage is countersunk. This hole is produced by a No. 50 drill (0.070 in. diameter) to a depth of $\frac{1}{4}$ in. Since only three tool-stations are used, the turret is arranged for double indexing, and the complete cycle occupies 12 sec.

STRADDLE MILLING TUBULAR SPACERS

When the mechanisms of Sumlock calculating machines are assembled, the frame plates (see MACHINERY, 93/64—9/7/58) are separated by tubular spacers. Spacers for manually-operated machines are made from aluminium alloy, and those for electrically-operated machines from En. 1B, bright mild steel. Generally, the components are of similar shape and dimensions, and a spacer for an electric Sumlock machine is shown in Fig. 6. This spacer is cadmium plated, and

to distinguish it from the light alloy parts it has a 0.005-in. deep, identifying groove A. Both types of components are produced mainly by means of a simple set-up on a single-spindle automatic, but to ensure that the end faces are the correct distance apart, and that they are parallel, also at 90 deg. to the bore, they are finished by straddle milling. This operation is performed on the steel spacers after they have been cadmium plated, and, on both types of spacers, 0.075 in. of metal is removed from each end.

Straddle milling is carried out on an Adcock & Shipley OD2 horizontal machine, and a general view of the set-up is given in Fig. 7. It will be observed that a manually loaded and operated fixture is employed. At one time, the machine and fixtures were arranged for automatic operation with hopper feeding, but an operator was required to monitor this equipment, and the mechanized arrangements afforded no advantage, since workpieces were milled no faster than with the hand-operated fixture. The 4-in. diameter by $\frac{3}{4}$ -in. wide, side-and-face cutters, with 24 teeth, are mounted on the arbor, and are run at 1,150 r.p.m. for the light-alloy parts, and at 750 r.p.m. for the steel spacers. The machine table is locked in position, and the workpieces are carried towards and away from the cutters by a slide in the fixture,

which is actuated by the lever seen in the operator's right hand. Using her left hand, the operator loads spacers into a V-groove on one side of the fixture, and pushes them into groove in the fixture slide. As a fresh spacer is loaded in this manner, a part that has been straddle-milled is pushed out of the groove in the slide, into a groove on the other side of the fixture body, and as successive workpieces are loaded, milled spacers pass into a curved chute *B*, whereby they are delivered into a work-pan. With this equipment, spacers are milled at a rate of 550 per hour.

The construction of the fixture is shown more clearly by the sectional and plan views in Fig. 8. The slide, indicated at *C*, is coupled to the operating lever by a link *D*, and is seen in the fully-advanced position. This position is controlled by a stop-screw, which is not shown. The slide is of dovetail section, and has a screw-adjusted gib at one side. A cranked lever *E* is pivoted in the slide and is free to move in a milled pocket. One end of the lever overhangs the V-section groove for the workpiece at the left-hand end of the slide (as viewed in Fig. 8), and at the other end of the lever there is a slot for a swinging crank *F*. A hole in one end of the crank embraces a stud that projects upwards from the lever *E*, and between the crank and the lever is fitted a compression spring. The relative positions of the lever and crank, and the pressure exerted on these components by the spring, can be adjusted by means of locknuts fitted on the portion of the stud that projects beyond the crank.

A slot is milled in the end of the crank remote from the lever, and between the arms thus formed is mounted a freely-rotating roller *G*. This roller bears on a hardened plate *H*, let into the fixture base, and when the slide is moved to the right—that is, away from the milling cutters—the roller moves along the plate, down an inclined face at one end, and into a pocket machined in the fixture base. With the roller in this position, the opposite end of the lever *E* is swung away from the V-groove in the slide. Travel of the slide away from the milling cutters is limited by the stop-screw *J*, and the setting of this screw is such that the V-groove in the slide is aligned with the V-groove in the block *K*, wherein the operator places the workpieces prior to thrusting them into the groove in the slide. As each workpiece is thrust into the slide groove, a milled spacer is ejected into the slide groove in the block *L*, opposite the block *K*.

When the slide is once more moved towards the cutters, the workpiece that has just been loaded is engaged by the guide plates *M*, which centralize it with the milling cutters. While the workpiece is still between the guide plates,

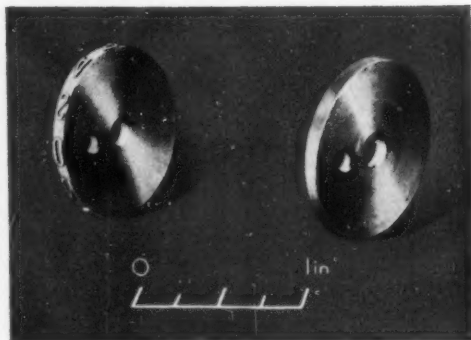


Fig. 9. A Typical Steel Printing Wheel and the Blank from which it is Produced. The Raised Characters on the Wheel are Formed by a Rolling Technique on a Milling Machine which has been Specially Equipped by the Company

the roller *G* travels up the inclined face at the end of the pocket in the fixture base, and passes on to the plate *H*. Through the crank *F*, the lower end of the lever *E* is raised, and the opposite end is thrust against the workpiece to clamp it in position. In addition to controlling the pressure exerted on the workpiece, the spring between the lever *E* and the crank *F* compensates for slight variations in the diameters of the spacers.

ROLLING NUMBERS ON STEEL DISCS

In an earlier article in this series (MACHINERY, 92/1200—23/5/58), reference was made to the engraving of identifying letters on printing wheels for Ultimate ticket-issuing machines. These wheels, it may be recalled, have raised characters on their peripheries, and are produced by die casting, the characters being formed by impressions in radially-sliding die members. Printing wheels for certain other machines in the Bell Punch Co.'s, range are made from circular blanks, machined from duralumin or steel, and the male characters on their peripheries are produced by a rolling technique. A typical steel wheel is seen at the left in Fig. 9, with a blank before letter-rolling at the right. The height of the characters is from 0.020 to 0.025 in., and this height includes an allowance for subsequent cylindrical grinding.

The rolling operation is carried out on a Kent Owens No. 1-14 horizontal milling machine, which has been specially-equipped by the company. A general view of the set-up is given in Fig. 10, and with the machine operating on a controlled cycle, a wheel is completely rolled in 1 min. The wheel-

blank to be formed is mounted in a special arbor assembly, fitted in the main spindle of the machine. This assembly consists of two main components, an arbor proper, and a sleeve, these parts being indicated at *P* and *R*, respectively, in Fig. 10. A gear, with 26 teeth of 0-1317 circular pitch, is formed integral with the arbor, and the latter is held in the sleeve by means of a No. 3 Morse taper shank and a socket-head screw. The sleeve carries a type BRL 1½ ball-bearing *S*, which is clamped against a flange at one end by two ring-nuts, and the sleeve is held in the machine spindle by a special taper shank and a draw-bar.

A blank to be rolled is mounted on a central, heat-treated, alloy-steel peg in the end of the arbor *P*, and its offset hole is engaged with a second, smaller peg, to ensure positive transmission of the drive. The blank is clamped by means of a rotating thrust member *T*, which is mounted in a support bracket on the over-arm of the machine, and the member *T* can be advanced or withdrawn by turning the star-wheel, at the left, through the action of a bayonet slot.

Characters are formed on the blank by a horizontally-disposed die assembly *U*, in the fixture on the machine table. There is a separate die for each character, and the upper faces of the dies, in which the female character-impressions are sunk, are mounted flush. The dies are clamped in a cradle, and the complete die assembly can be raised by a ratchet-and-cam actuated wedge mechanism. During each rolling cycle, the machine table reciprocates continuously, and the work-carrying arbor is driven by a rack on the fixture, which meshes with the integral gear-teeth. The die-elevating mechanism is operated by the lever *V*, which carries a freely-rotating roller at its inner end. As the table moves to and fro, the roller contacts the bearing *S*, on the work arbor, and the lever *V* is depressed and released.

Details of the fixture are shown in Fig. 11, which has been lettered to correspond with Fig. 10, where applicable. When the lever *V* is depressed, the spring-loaded pawl *W* engages the teeth of the ratchet wheel *X*, and causes the latter to rotate in a clockwise direction (when viewed in side elevation, as at the bottom in Fig. 10). A second pawl *Y* prevents the ratchet wheel from rotating, as the lever moves upwards. The ratchet wheel is keyed to a shaft *Z* which carries two cams *A* and *B*. Drive is transmitted from the shaft to the thicker cam (*A*) by a peg that projects from a flange on the shaft, and the thinner cam (*B*) is secured to the thicker cam by three screws, which pass through arcuate slots. Both cams engage a roller *C*, which is mounted on the end of the horizontally-sliding wedge *D*. Thrust is

applied to the opposite end of the wedge by a spring-loaded plunger *E*, so that the roller is held against the peripheries of the cams. The wedge *D* supports a second wedge *F*, which is free to slide vertically in the fixture, against the downward force exerted by springs on the large, flat heads of two pillar bolts *G*. Both wedges are made from alloy steel, and are hardened and ground, and the cradle that holds the dies *U* is secured to the upper face of the wedge *F* by screws and dowels.

As the lever *V* is repeatedly depressed and released by the ball bearing *S*, during successive reciprocations of the machine table, the cam *A* advances the horizontally-sliding wedge *D*, against spring pressure, and the wedge *F* and the dies *U* are raised. The arrangement is such that the dies are lifted through approximately 0.0005 in. during each forward and return movement of the table. For the workpieces seen in Fig. 9, the dies are raised progressively while the table makes 22 reciprocations. At the end of this sequence, an arcuate portion of the profile on the cam *A* is in contact with the roller *C*. Due to springing of the

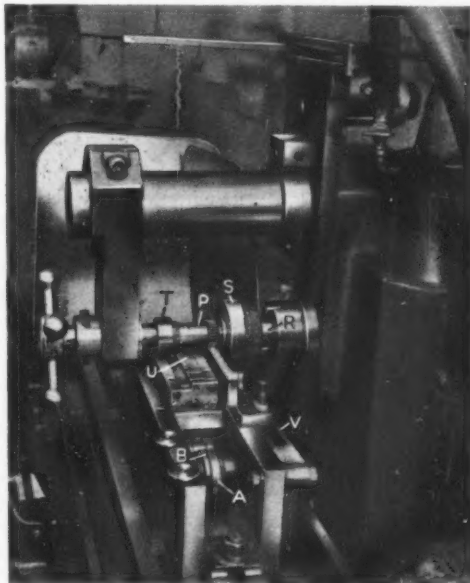


Fig. 10. The Set-up on a Specially-equipped Kent Owens Milling Machine for Rolling the 0-020/0-025-in. High Characters on Steel Printing Wheels. A Wheel is Character-rolled in 1 min., the Machine Table Reciprocating Continuously under Automatic Cycle Control

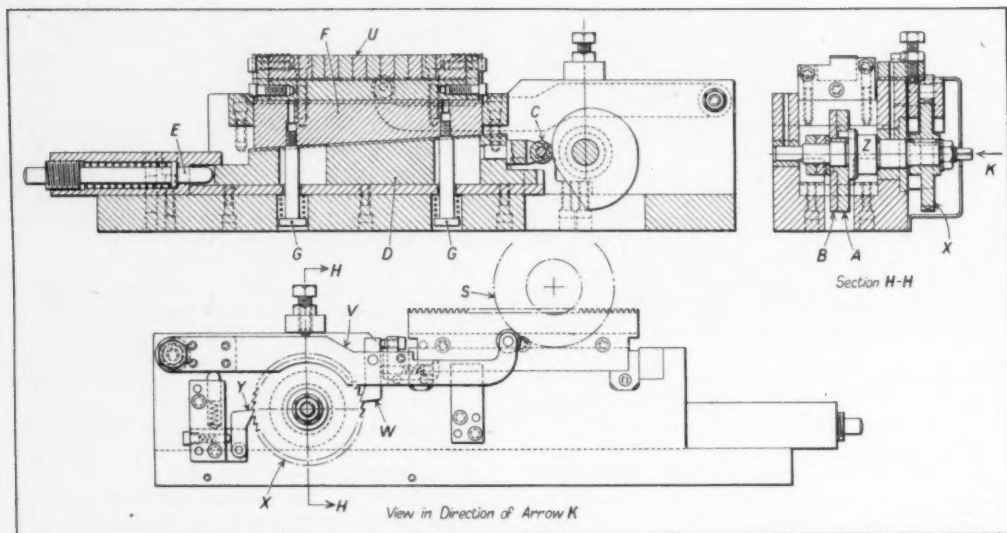


Fig. 11. Details of the Ratchet-and-cam Actuated Wedge Mechanism for Raising the Die Assembly of the Character-rolling Equipment are Here Shown. The Dies are Raised Approximately 0.0005 in. Each Time the Fixture is Moved Towards and Away from the Work-carrying Arbor

various members of the fixture, and to allow for slight elastic recovery in the work-material, it is necessary to continue rolling with the dies maintained in their final vertical setting, but the duration of this second rolling stage depends on the characteristics of the material that is being rolled. To provide for varying the length of this second stage, the cam *B* has an arcuate profile, of the same radius as that of the cam *A*, and the duration of the second stage can be adjusted by altering the relative positions of the two cams, the arcuate portion of the cam *B* extending beyond that of the cam *A*.

Reciprocation of the machine table is continued until the ratchet wheel and cams have been rotated through 360 deg., after which the machine is stopped by the operator. There is a steep "drop" at the end of the arcuate portion of each cam, so that the cams are disengaged from the roller *C* when the operation cycle has been completed. The wedge *D* is held in the advanced position, however, due to the downward force exerted by the work on the dies and the wedge *F*. This force is released, and the wedge is returned to its initial position in readiness for the next cycle of opera-

tions, by re-setting the lever seen at the top of the machine, in Fig. 10.

The lever actuates a cam mechanism whereby the complete head of the machine can be raised and lowered, and the travel of the lever is controlled by a gate. With the head in its upper position, the workpiece is clear of the dies, but the gear teeth on the arbor are still in loose mesh with the rack on the fixture.

HEAT-TREATMENT FACILITIES

Adjoining the machine shop, there is a well-equipped heat-treatment department. Approximately 53,000 components pass through this department each week, and the equipment includes three cyanide hardening furnaces (Incandescent Heat Co., Ltd.); two Wild Barfield electric furnaces, one of 12- and the other of 10-kW. rating; a Radyne 5/7-kW. high-frequency induction-heating unit; a normalizing salt bath and two tempering baths supplied by the Gas, Light and Coke Co., Ltd.; and an I.C.I. neutral salt bath. In addition, there is a Vickers hardness-testing machine and the necessary auxiliary equipment, such as a degreasing plant and washing tanks.

A close-up view of the I.C.I. salt bath is given in Fig. 12, and it is provided with two pots, one of which (at the right in the illustration) is used for preheating the work. Cassel WS 720 neutral salt is used in the other pot, with the addition of the supplier's regenerator *A* to prevent decarburization of the work-surface. The photograph

from which Fig. 12 was prepared was taken with the salt at 800 deg. C., and it will be observed that the molten salt is quite transparent, and that its surface is clear, as is evident from the fact that the lower portion of the vertical pipe *H*, although immersed, can clearly be seen. Owing to this characteristic of the salt, the work is visible while it is being treated. This salt also has the advantage that it is water-soluble, so that it can readily be removed from the work after the treatment has been carried out.

To facilitate the induction hardening of gears on the Radyne unit, the company have developed the equipment seen in Fig. 13. Two slotted brackets *K* are mounted on slats above the water-bath that provides for quenching, and carry a bridge-member *L*, which is adjustable for height to suit different workpieces. The bridge-member supports an electro-magnet *M*, connected by a length of flexible cable to the outlet socket associated with the process timer of the Radyne unit.

There are two core-pieces that project downwards from the electro-magnet and pass through the bridge member. At the lower end of each core-piece there is a brass shoe, as at *N*, which has slots for the passage of the securing screws, to provide for height adjustment. Fitted to the flanges of the shoes is a Sindanyo plate *P*, with

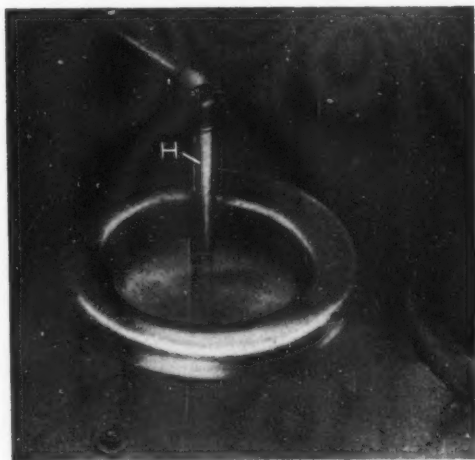


Fig. 12. Cassel WS 720 Neutral Salt is Used in the Left-hand Pot of this L.C.I. Salt-bath Furnace, and is Completely Transparent when Molten. The Salt is Water-soluble, and can Therefore be Removed Readily. A Second Pot at the Right is Employed for Pre-heating the Work

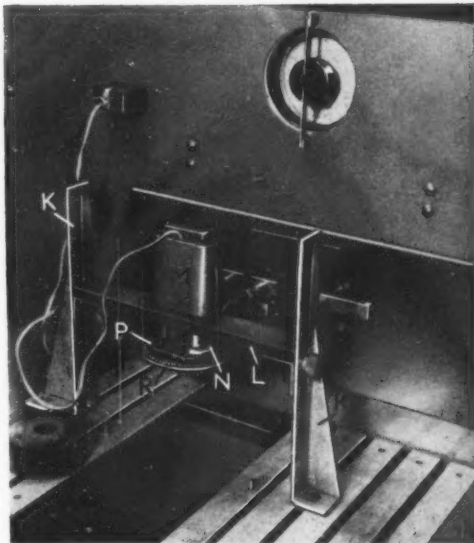


Fig. 13. This Equipment is Employed on the Radyne 5-kW., High-frequency, Induction-heating Unit for Hardening Gears. Each Gear is Held by an Electro-magnet within a Single-turn Work-coil, and is Automatically Released into the Quenching Bath below at the End of a Pre-determined Period.

two holes to clear the core-pieces, and a central domed-head brass location bung. When the electro-magnet is energized, a gear to be hardened can be placed in contact with the Sindanyo plate, centralized by engaging its bore with the location bung, and held in position by magnetic force. By varying the settings of the shoes, the air gap between the gear and the ends of the cone pieces can be modified.

A gear may be seen at *R* in Fig. 13, held in the manner described, and it is located within a single-turn, water-cooled conductor coil. There are "low," "medium," and "high" outlet terminals on the Radyne unit, and, in this instance, the coil is connected to the "medium" terminals. With the gear in position, the operator engages the automatic cycle of the unit, and high-frequency current is supplied to the coil, to heat the workpiece. At the end of 13 sec., the process timer of the unit cuts off the high-frequency supply to the coil, and the current to the electro-magnet. The red-hot workpiece then falls into the quench tank below. The holding arrangements are also employed for two other gears, which are induction hardened.

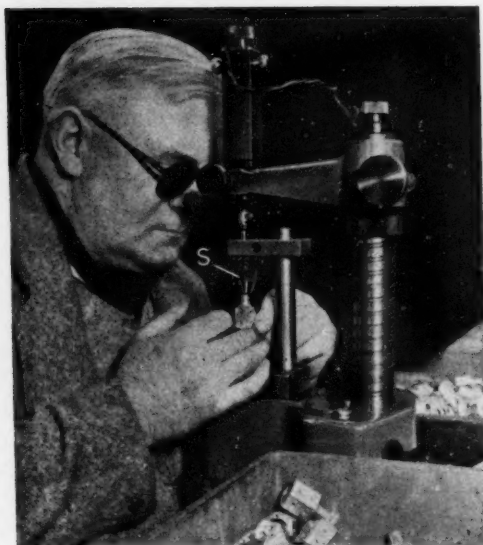


Fig. 14. This Blind Operator has been Engaged on Inspection Work for More than Eight Years, and is Here Seen Checking the Depth of the Hole at Each End of a Workpiece, with the Aid of a Sigma Audible Comparator. A Bell Rings when the Depth of the Hole is within the Pre-set Tolerance, and High- and Low-pitched Buzzing Sounds Indicate that the Upper and Lower Limits, Respectively, have been Exceeded

BLIND INSPECTOR

It will be apparent from this and the preceding articles that the company pay considerable attention to the accuracy of the components used in their products, and at one side of the machine shop there is a large inspection department. Among the workers in this department is a blind inspector, who is seen in Fig. 14 engaged in checking the depth of the hole at each end of a die cast transmitter body, after it has been machined. Each hole is bored to 0.2177/0.2187 in. diameter, and its depth is 0.247/0.253 in. The blind inspector has been engaged in this type of work for some eight years, and, as may be seen, uses a Sigma audible comparator, which is fitted with adapters to suit the components that are being inspected. These adapters are designed and made by the Bell Punch Co., Ltd.

In this instance, the adapter consists of a simple housing S in which there is a sliding, spring-loaded plunger. The housing has a threaded shank, and is screwed into the horizontal arm of a stand on

the base of the comparator. A lock-nut is provided to secure the housing in position, and the stand can be adjusted relative to the comparator in a dovetail slide. The upper end of the sliding plunger contacts the stylus-point of the Sigma comparator, and the equipment is set by means of a master component. The knurled knobs at the upper end of the comparator provide for setting the tolerance range, one knob controlling the upper, and the other, the lower limit.

When using this equipment, the inspector passes a component to be checked over the sliding plunger, so that the lower end of the plunger engages the shoulder at the bottom of the hole. He then lifts the workpiece, and with it the plunger, until the end face of the component contacts the lower surface of the housing S. With the workpiece thus positioned, the Sigma comparator emits a ringing sound if the depth of the hole is within the pre-set tolerance, a low-pitched buzz if the depth is less than the lower limit, and a high-pitched buzz if the upper limit is exceeded.

Further production set-ups and equipment employed by the Bell Punch Co., Ltd., will be described in succeeding articles in this series, to be published shortly in MACHINERY.

I.C.I. RAPID DRYING AGENT—A new technique for the rapid drying of metal articles has been introduced by Imperial Chemical Industries, Ltd., Millbank, London, S.W.1, and forms the subject of a patent application. Parts are treated in liquid trichloroethylene containing a special additive known as Trisec, and it is stated that freedom from staining is thus ensured, even for bright plated and polished surfaces. Trisec is effective at moderate temperatures, so that advantage can be taken of the low heating requirements of trichloroethylene.

Work can be conveniently processed with a simple installation similar to a standard degreasing plant, but incorporating a water separator. Extra freeboard is provided about vapour level, and arrangements are made for rim ventilation. One compartment, containing Trisec, is used for the drying operation, and in the other, the parts are subsequently rinsed in pure boiling trichloroethylene. The process is completed in about 1 min.

COAL CUTTING MACHINERY IN THE U.K.—During 1957, 702 coal cutters were delivered and 142 were exported. The corresponding figures for the year 1956 were 715 and 91. During 1957, 509 power loaders (including cutter-loaders) were delivered, and 24 were exported, the corresponding figures for 1956 being 377 and 44.

Developments in Precision Boring*

By C. L. DAVID, Dipl.-Ing.†

Precision boring has been developed as a production method over the past 25 to 30 years to supplement reaming and grinding for finishing accurate holes in parts which are made in quantity.

Machines developed for this purpose are available with multiple spindles which are arranged vertically or horizontally. Vertical-spindle machines have the advantage that the loading of some work, and particularly large pieces such as motor-car cylinder blocks, is facilitated, but the majority of fine borers are built with horizontal spindles. Machines of the latter type are more versatile and can be made in double-ended and multi-way forms.

Although the basic machines can be adapted for many different applications, they are usually set up for single-purpose operation, and large numbers of parts must be produced to justify the cost of fixtures, boring bars and tools. There are exceptions, however, where the inherent accuracy of the method justifies the expense, even with small-quantity production.

The purpose of precision boring is to produce holes which, within close limits, are of the correct size; round; straight (cylindrical or conical); in the correct position relative to other holes or datum faces; and of the desired standard of surface finish. Satisfactory achievement of this purpose depends upon various factors, some of which are here discussed.

CLAMPING THE WORK

The production of round holes depends mainly on the accuracy of the machine spindle and its bearings, but also on the workpiece, and particularly the manner in which it is located and held during boring. After the suitability of the workpiece material has been determined, the method of clamping is a decisive factor when considering the application of precision boring as a production process. It must be possible to hold the piece in such a manner that clamping will not distort it, so that holes will remain round after the work has been removed from the machine.

In this connection, it should be pointed out that,

in many instances, precision boring is employed for finishing only because clamping at previous operations has caused distortion.

It follows, therefore, that the designer who requires round holes of a high degree of accuracy must provide locating faces and clamping pads. Sometimes, locating lugs are afterwards removed. In other instances, the lugs may be left on the finished product, although they no longer fulfil any useful purpose.

Locating faces must be sufficiently flat to ensure roundness of the bores in the components. Errors of flatness of as little as 0.003 in. in the end faces of motor-car pistons, for example, can cause the gudgeon-pin bores to be as much as 0.0002 in. out-of-round. Apart from roundness, alignment, parallelism, and the positions of holes will be affected if the workpiece is inadequately located and incorrectly clamped.

Distortion may be caused by clamping in a vice, and the use of spanners. Similarly, cam and toggle clamps must be used with discretion so that they neither distort the components, nor the fixtures. Where any likelihood of distortion exists, compensating and load-limiting clamping mechanisms must be provided.

Cutting forces in precision-boring operations are comparatively light, and hand-operated clamps are normally adequate. Where possible, boring pressure should be exerted against the locating face rather than against the clamp. Pneumatic or hydraulic operation of clamps involves greater expenditure for equipment, but reduces operator fatigue and ensures evenness of clamping pressure. Such clamps are therefore economical where large quantities of parts are involved, and where the clamping time represents a considerable part of the total cycle time.

Double-ended fine boring machines with moving tables are most economically employed when the loading time is equal to the machining time. In these circumstances, a part can be loaded at one end while boring is being performed on another piece at the other end. It may also be an advantage, as regards production time, to load a component twice if it is to be machined at both ends, provided that the relocation will not have an adverse effect on accuracy. If, however, to obtain the specified accuracy the component must

* Abstract of a paper presented at the Conference on Technology of Engineering Manufacture arranged by the Institution of Mechanical Engineers.

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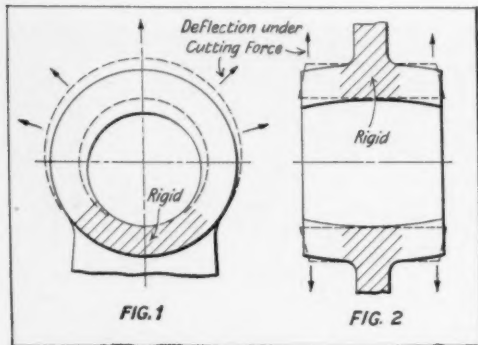


Fig. 1. Diagram Showing How, During Boring, the Less Rigid Parts of a Component May be Deflected by the Cutting Force

Fig. 2. Deflection of the Bosses of this Component During Boring Produced a "Barrel-shaped" Hole

be traversed to both ends of the machine at the same setting, the loading time cannot overlap the machining time.

EFFECT OF CUTTING FORCES

Although the cutting forces in fine boring are normally light, as compared with those involved in other machining operations, they cannot be ignored. The cutting force can cause the less-rigid parts of a component to be deflected from their normal positions, which are, however, resumed when the cut has been completed. As a result, an out-of-round hole, for instance, may be produced. A component with this defect is shown in Fig. 1, from which it will be seen that the hole radius is ultimately smallest where the greatest deflection occurs. In Fig. 2 is shown a part in which a barrel-shaped hole has been produced as a result of deflection of the bosses during boring.

Other causes of out-of-roundness are an uneven machining allowance and faulty alignment between the axes of the bar and hole, both of which result in variation of the depth of cut. Under these conditions, uneven deflection of the boring bar may occur during cutting. It is often necessary, therefore, to take two cuts—one to reduce eccentricity, and a second to finish the hole to size. For this purpose, two tools may be mounted in the same boring bar, but care must be taken to ensure that the semi-finishing tool has left the bore before the finishing tool starts cutting.

Sometimes, a component lends itself conveniently

to this method of boring, and Fig. 3 shows a piston where the distance between the bosses is greater than the length of one boss. The semi-finishing tool passes through the first boss, and is followed by the finishing tool. The second boss is then bored in a similar manner.

Obviously, roundness cannot be achieved if the spindle carrying the tool bar and tool, or the component, does not run true or deflects by varying amounts in different directions. Spindles and their housings must therefore be made as rigid as possible, and bearings of a very high degree of accuracy must be employed. Most fine boring spindles are mounted in angular contact ball-bearings which are spring pre-loaded to reduce running clearances, so that rigid support is provided. Usually, the spindles are made with integral flanges, and with this arrangement, boring bars with lapped faces can be fitted without disturbing the fit and clearance of the spindle bearings.

Spindles are normally made as independent units, which can be positioned to suit the centres of the holes to be bored, and can be accurately aligned to ensure parallelism of the spindle axis and table movement. If the axis is not parallel with the direction of movement, the holes produced will be elliptical when the tool is rotated and the component is traversed. Conical bores are obtained when the component is rotated and the tool is traversed. These methods are, of course, deliberately employed when elliptical or conical holes are required.

When two or more tools are mounted in the same bar, misalignment of the spindle axis and the slide movement can result in lack of concentricity, as indicated in Fig. 4.

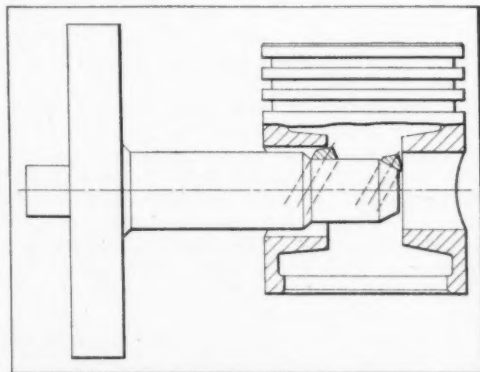


Fig. 3. The Two Gudgeon Pin Holes in this Piston are Rough-bored and Finished, at One Setting, by the Use of Two Tools Mounted in the Same Bar

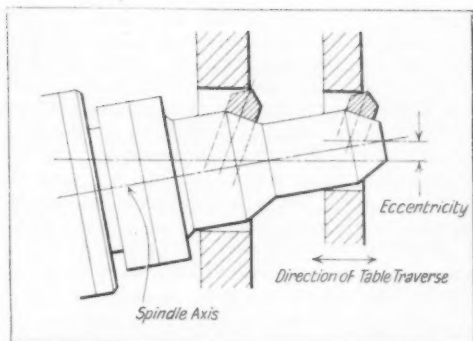


Fig. 4. Because of Misalignment of the Spindle Axis and Work Slide these Bores are Not Co-axial

ACCURACY OF SLIDE MOVEMENT

Straightness of bored holes depends largely on the accuracy of the machine slides. For precision boring machines, slides are designed with long vee and flat guiding surfaces which are fully supported on the machine beds throughout the working strokes, and are provided with covers and wipers. Lubrication requires particular attention, to ensure the presence of an oil film of even thickness, and the type of oil used and the method of application to the slides must receive careful consideration. Beds must be sufficiently substantial to ensure that any variation in the distortion of the slides as they are traversed is kept to a minimum. It is also necessary to provide adequate support for the beds on the foundations. If there were no distortion of the bed, a 3-point support would be preferable, but this arrangement is practical only for short machines.

The surest and simplest method of checking the straightness of a slide is by means of a spirit level. Use of a level facilitates the manufacture of a straight slide, and provides a ready means of verifying that the initial accuracy has been maintained.

Many fine boring machines are hydraulically operated, and the heat developed in the hydraulic system may affect the table level and its

movement. For this reason, the oil tanks are normally mounted independently of the machine bases. On some machines, provision is made for circulating warm air through the bridges supporting the spindles. In other instances, cooling units are provided to keep the machines as nearly as possible at ambient temperature, and thus obviate expansion which causes distortion and misalignment of parts.

Heat developed in spindle bearings results in changes in the position and level of the spindle axis, and although these changes may not directly influence the straightness of holes, their positions relative to datum points and to other holes are affected. Where the component is rotated, moreover, errors in hole size are also introduced.

WORK-HOLDING FIXTURES

Correct positioning of holes also depends on the alignment and accuracy of work-holding fixtures, and spindles. If several holes are to be bored at one end of a component and are closer together than the desirable minimum centre distances for the spindle units, an indexing slide of the traversing or rotary type is used. Normally, the slide carries the fixture and is operated either by hand (mechanically) or hydraulically. Since hydraulic operation requires an accurate positive stop, preferably in line with the operating piston rod, the normal arrangement provides for two positions—front and rear. Additional operating cylinders and pistons can be employed to provide further positions, and Fig. 5 shows an arrangement of two pistons and one cylinder, which provides for three positions of the slide.

When heavy components are to be handled and long indexing strokes are required it may be more satisfactory to cross-index the spindles, so that excessive overhang of the cross-slides is avoided.

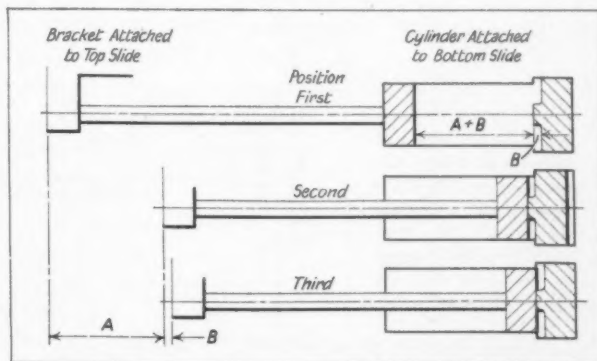


Fig. 5. An Indexing Arrangement Incorporating One Hydraulic Cylinder with Two Pistons, to Provide Three Positions

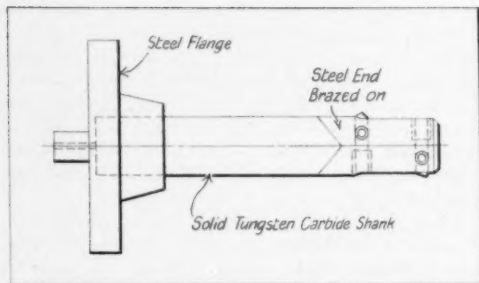


Fig. 6. Boring Bar with a Tungsten Carbide Shank Shrunken into Steel Flange. A Steel End-piece, which Carries the Tools and the Adjusting and Clamping Screws, is Brazed to the Shank

CARBIDE TOOLS AND BORING BARS

Development of precision boring as a production process has been largely due to improvements in carbide tools. The use of single-point tools of this material has become well established, and they are usually mounted in boring bars which are not supported at the outer ends. Diameters of boring bars are restricted by the sizes of bores in the work and fixtures, and rigidity can only be increased by reducing the length of the bars, or by using a material with a higher modulus of elasticity. Rigidity of a boring bar is directly proportional to the modulus of elasticity and the fourth power of the diameter, and inversely proportional to the third power of the overhanging length.

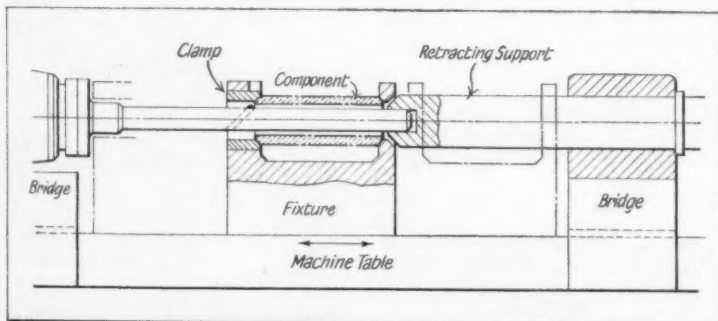
The modulus of steel is approximately 30,000,000 lb. per sq. in., and of tungsten carbide, from 70,000,000 to 90,000,000 lb. per sq. in. Experience has shown that length/diameter ratios up to 4 : 1 give satisfactory results with steel boring bars, whereas ratios up to 7:1 can be employed with tungsten-carbide boring bars. Although

tungsten-carbide boring bars are more expensive than those made of steel, their use is often justified, since they enable results to be achieved which could not otherwise be obtained so readily. Such bars have found increasing application during the last few years. Where the bar is of the non-rotating type, the tool bit is brazed on to the end of the shank, which is held in a tool-post with the necessary means for fine adjustment for setting purposes. A rotating bar has a steel flange which is shrunk on to tungsten carbide shank, and a brazed-on steel end carries the tools and the clamping and adjusting screws, as shown in Fig. 6.

In instances where length/diameter ratios exceed 4:1 and the use of tungsten carbide bars is impracticable, it may be necessary to provide out-board supports, although such supports introduce several disadvantages. They can be used only for through bores, and the boring bars must be more than twice the length of those which are unsupported. Also, a considerably longer traverse is necessary to provide loading clearance for the workpiece. Alternatively, the boring bar must be detachable, so that it may be passed through the components after the latter has been loaded. Support bearings, which must be very accurately aligned with the spindles, are liable to wear. If tools are to slide through the supports, moreover, provision must be made for the angular positioning and locking of the bushes. Preferably, supports should be of the rotating type, with adequate lubrication and minimum clearance for the bar.

If supports are incorrectly aligned they will cause the boring bars to be deflected so that the resulting holes will be oval and inaccurately located. When supports move with the workpiece, even if they are correctly aligned, they may cause "bell mouthing" of holes, since the distance from the tool point to the support, and, consequently, the deflection of the boring bar, varies continuously. Where possible, therefore,

Fig. 7. Arrangement of Retractable Boring Bar Support to Facilitate Loading and Unloading the Work. The Distance from the Support to the Tool Remains Constant



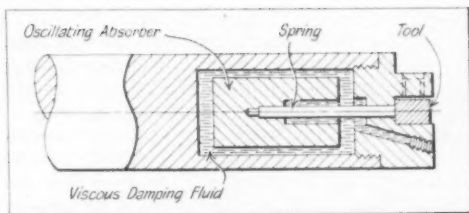


Fig. 8. Boring Bar with "Tuned" Vibration Absorber

the support should be kept at a constant distance from the tool point. Such an arrangement is shown in Fig. 7.

The main drawback associated with long boring bars is vibration, which results in chatter. Despite some investigations into its nature (Arnold, 1946; Doi and Kato, 1956; Hahn, 1953), the cause of chatter is still only imperfectly understood. By increasing the stiffness and rigidity of boring bars and tools, their natural frequency is increased, and higher speeds can be employed without danger of resonant vibrations in the bars. A limit is reached, however, when the maximum boring bar diameter and minimum overhang for a given hole are used, and the bar material has a high modulus of elasticity. A development of recent years is the introduction of vibration dampers built into boring bars (Hahn, 1951). Such a damper consists of a heavy slug carried at the forward end of the boring bar in a recess of slightly larger diameter. As the bar vibrates, the slug tends to remain in one position, and air is displaced from one side to the other. Vibration energy is thus absorbed, and the movement of the bar is damped. The slug should preferably be at the extreme end of the bar, in front of the tool. Where such an arrangement is not possible the slug is carried behind the tool.

A variant of this arrangement is the subject of a patent by P.E.R.A. and F. A. Lewis. In place of a free-floating plunger, a spring-mounted absorber in a viscous liquid is provided. The effect of the absorber can be altered by varying the mass of the weight, the spring rate of the support spring, the viscosity of the liquid, and the difference in size between absorber and container. It will be interesting to learn how application of this absorber will affect the useful length/diameter ratio of boring bars. No doubt considerable research will yet be necessary to establish optimum conditions and dimensions for the solution of practical problems. A sectional view of this boring bar is shown in Fig. 8.

SOURCES OF CHATTER

Chatter vibrations are excited by the boring process, and are attributable mainly to boring bars and tools (apart from the workpiece itself). In addition, forced vibrations are caused by errors and inaccuracies of rotating members of the machines.

Ball bearings for spindles, although of the highest degree of accuracy and uniformity, are not completely free of irregularities, and plain bearings are still preferred where the very highest degrees of finish are desired.

IMPORTANCE OF BALANCE

High cutting speeds and fine feeds per revolution do not always produce better finishes than lower speeds and coarser feeds, probably because of the effects of lack of balance and of spindle-bearing irregularities, which are more detrimental at higher than at lower speeds. No increase in useful production results from the use of speeds above an optimum, and there is increased tool wear and reduced spindle life. Increasing attention is being paid to careful balancing. Boring and facing bars mounted on cross-feed units are so arranged that automatic adjustment of balance is obtained as they are moved transversely; one method of achieving this result is indicated in Fig. 9.

Wherever possible, the use of gears in spindle drives is avoided on precision boring machines. Plastics, leather-faced flat belts, which have be-

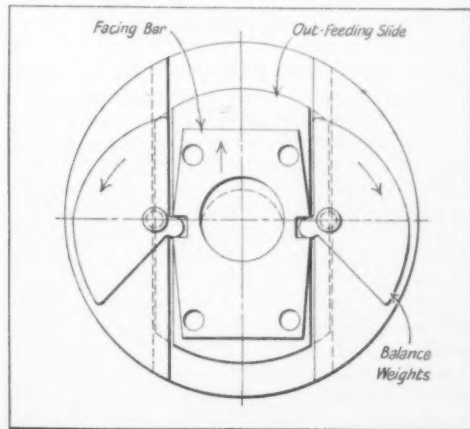


Fig. 9. Balance of the Boring Bar is Automatically Maintained by this Arrangement of Weights

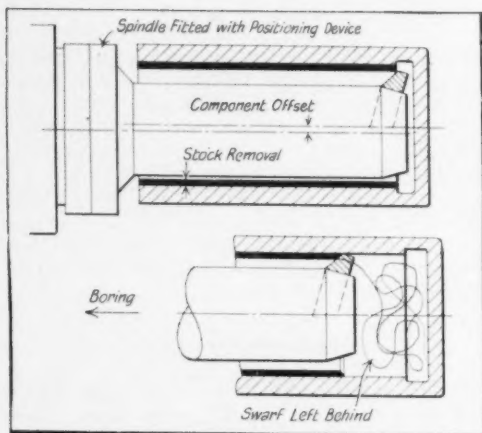


Fig. 10. When Boring is Carried Out on the Return Stroke, the Space Vacated by the Boring Bar is Available for Chips

come available in recent years, have smoother-running properties than endless V-belts which have held the field for a long period. It is interesting to note that link belts, which were in use before endless V-belts, and have been largely supplanted by them for precision applications, are often superior in performance where smooth, vibration-free transmission is required. Further applied research would be welcome to establish the best conditions for the various forms of drive.

DISPOSAL OF SWarf

It has already been pointed out that, for reasons of rigidity, boring bars must be made as large as the holes will permit. However, it must be borne in mind that the disposal of swarf imposes limitations. It is generally understood that stock removal in precision boring is kept to the minimum required for efficient operation. Increased stock removal would involve larger cutting forces, greater distortion of components, due to these forces, and consequent distortion of fixtures, larger deflections of boring bars, and increased tool wear. It might, therefore, prejudice the success of the fine boring operation. In some instances, however, the rigidity of the components permits heavy stock removal, while maintaining a high degree of accuracy in the finished bores. For such operations, adequate clearance for tool and bar is essential. Even with comparatively light cuts, however, it is necessary to consider the removal of swarf from the hole,

because cuttings tend to wrap round the boring bar or lodge between the tool and the bore, and thus impair the surface finish. Difficulties in this respect are particularly likely to arise when ductile materials of high tensile strength are bored.

One way of overcoming this problem, with blind bores, is to advance the tool into the component, and bore on the return stroke. This method also avoids a tool return line, which is often undesirable in a finished bore.

To introduce the tool it is necessary to locate it in a certain angular position, and to offset the component in the same direction. In the example shown in Fig. 10, the required result is obtained automatically by means of a spindle locating unit, and a hydraulically-operated cross slide on which the work fixture is mounted.

TOOL ADJUSTMENTS

Success in a precision boring operation often depends on the choice of the cutting tool and the method of adjustment. Since the tolerance for size is usually of the order of 0.001 in. on diameter, or less, very little tool wear is permissible. It often happens that a tool is still capable of producing a well-finished, round bore but has worn below the permissible limit for size. Efficient and accurate means of adjustment by a few ten thousandths of an inch are therefore necessary. If such adjustment is not available, or if tool wear, due to the abrasive nature of the work material, for example, is excessive, final sizing of the bore may have to be performed by honing or grinding.

It may, however, still be desirable to carry out a precision boring operation first, in order to bring the hole into the correct position, parallel to another hole and at the required centre distance. The subsequent operation may then be rapidly performed, since it is only necessary to obtain correct size and roundness, straightness and accuracy of location having already been achieved by precision boring.

ROUGH- AND FINISH-BORING WITH GUN DRILLS

It has been assumed, or implied, that an initial roughing operation, to remove the bulk of the metal, must normally be carried out prior to precision boring. Such an operation is liable to cause distortion, on account of the comparatively heavy cutting forces employed, and the clamping pressures necessary to oppose them. To overcome this problem, gun drills may be employed, particularly for holes with large length/diameter ratios. With these drills, the roughing and finishing operations are combined.

To achieve the desired standards of roughness, straightness, and surface finish, all the requirements previously indicated, as regards rigidity and accuracy of machine, spindle, and drive; and component location and clamping, must be observed. In addition, particular attention must be paid to the guide for supporting the tool when it first enters the bore and to the supply of cutting lubricant of the right kind. Even for small holes, of about $\frac{1}{8}$ in. diameter, quantities of 5 to 10 gal. per min., and pressures of 300 to 1,000 lb. per sq. in. are required to remove the cuttings from the bore. High cutting speeds, in conjunction with fine feeds of 0.0003 to 0.001 in. per rev. can be employed, and very high production rates can be obtained, with roundness errors within 0.0005 in., and straightness of the order of 0.0005 in. over 6 in. It is particularly interesting to note that these results can be obtained with a rotating drill and non-rotating workpiece and a very good surface is produced.

MULTI-SPINDLE MACHINES

A common feature of precision boring machines has always been the use of several spindles, either to produce a number of holes in one component, or for machining several components simultaneously. The number of spindles employed is restricted by their size, which determines the minimum centre distance. Where hand loading is employed, the number is also limited by considerations of convenience in loading, since the operator must reach past the front stations to load at the rear positions. This difficulty has led to the development of machines which can be loaded from the ends, and of indexing fixtures which enable loading to be carried out while boring is in progress.

AUTOMATIC LOADING DEVICES

Automatic loading devices have also been introduced to provide for fully-automatic cycles. A further development, which is common to other types of machine tools, is the use of transfer and linking mechanisms, for joining several units. This development will logically lead to the incorporation of automatic gauging devices, and equipment for compensating for tool wear automatically. So far, however, the provision of such arrangements is only in its early infancy, and is hardly economic. It is obvious, however, that so long as the cutting tools used are subject to fairly rapid wear, compared with other parts of the machine and equipment, the problem of tool changing and tool setting must receive more attention. In view of the small

errors permitted, tool setting and adjustment occupy, proportionately, much more time in precision boring than in other processes where the tolerances are less exacting.

VARIOUS METHODS OF MACHINE CONTROL

The development of precision boring as a production technique has proceeded simultaneously with the introduction of hydraulic equipment for metal-cutting machine tools. Most precision boring machines, therefore, have been provided with hydraulic equipment. Table, cross-slide, and indexing movements, in particular, have hitherto been hydraulically operated. Initially, most of the control elements for these motions were also hydraulic. For some time now, however, the trend has been towards electro-hydraulic control, or, alternatively, cam-control. Electric control of the valves for the hydraulic mechanisms permits greater versatility and simplifies the change-over from one type of cycle to another, but it introduces other problems, particularly as regards service and maintenance. With the combination of equipment of mechanical, hydraulic, and electrical types, and the consequent complications, reliability tends to be impaired.

Mechanical cam controls are more easily understood, and once they are correctly made and adjusted are more likely to work reliably over long periods. On the other hand, cams are expensive to make and apt to wear, and when they are employed, changes in work-cycles present more difficulty. The recently developed cam-controlled precision boring machines, nearly all of which are single-ended, will therefore be utilized mainly for large-quantity production runs, on comparatively small components requiring short boring strokes.

FUTURE TRENDS

No doubt, the newer systems of electric and electronic control, based on punched cards, punched tape, and magnetic tape, for positioning workpieces and tools for automatic working cycles, will, in due course, be used on precision boring machines. At present, owing to their expense and complication, they are likely to be confined to prototype and small-quantity production, and to machines of the jig-borer type. These machines, and the associated processes, although they certainly belong to "precision boring" in the wider sense, have not been considered in this paper, which has been confined to production machines.

Owing to their simplicity, inherent rigidity, and accuracy, "precision boring" machines, originally developed for boring only, have been increasingly

adapted for many related operations, and, in particular, precision turning of cylindrical, conical, and oval components, contour turning and facing, and milling. In many instances, these adaptations, permitted by the versatility of the basic machines, have enabled grinding, lapping, and scraping operations, which were previously employed, to be superseded.

With the increased use of accurate die castings, shell mouldings, precision forgings, and pressings, the precision boring machine is likely to find wider

application in the future for finishing such components. These parts will require no other metal-cutting roughing operations owing to the small machining allowances which their accuracy permits.

Future developments, apart from those associated with operating mechanisms and controls, are likely to result in improvements in vibration characteristics of machines and boring bars, reduced distortion due to heat from spindles, hydraulic equipment, and motors, and better spindle bearings and driving arrangements.

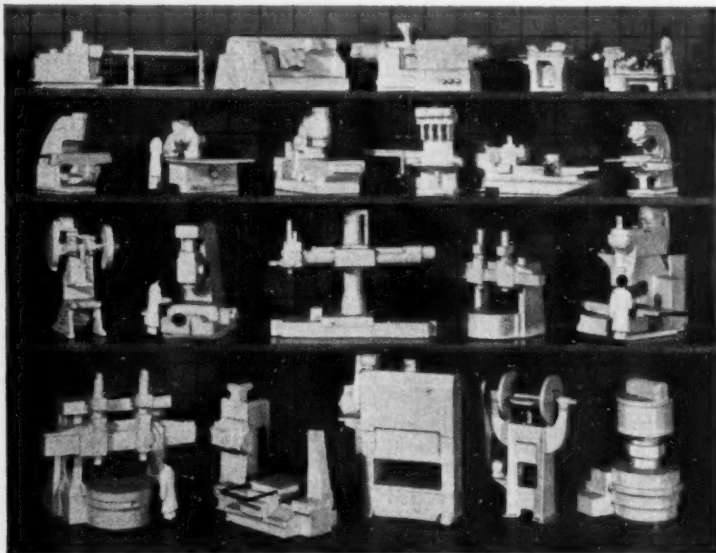
Models For Visual Planning

In the accompanying illustration are seen some examples from the range of models of standard machine tools currently available from Visual Planning Systems, Ltd., Athlon Road, Manor Farm Estate, Alperton, Middlesex. These models are made to the scale of $\frac{1}{4}$ in. to 1 ft., and the lines ruled on the background represent distances of 3 ft., to the same scale. A new edition of the company's handbook, now obtainable at a cost of 5s., gives details of numerous additions to the range of models and other equipment to the scale mentioned, also of a new range to the scale of $\frac{1}{4}$ in. to 1 ft. Since the handbook was last published, the number of stock patterns has been

increased by approximately 1,600, of which approximately 500 are to the new scale. In addition to the list of models, and illustrations of examples, contained in the handbook, there is a discussion of the advantages of using such model systems in planning factory layouts.

Here, it is explained that although the $\frac{1}{4}$ -in. scale is considered preferable, for the sake of clarity in the model forms which permits easy recognition, and for other reasons, the new $\frac{1}{4}$ -in. scale has been introduced for use in very large layouts, or where only limited space is available for setting up. In addition to models of machine tools, the ranges include baseboards marked with

lines at 1-ft. or 3-ft. intervals, benches, stanchions, partitioning, conveyors, industrial trucks, male and female operators in standing and sitting positions, and office furniture. Consequently, planning layouts of entire factories can be produced with almost entirely standardized model units. Coloured pressure-sensitive adhesive planning tape, of $\frac{1}{4}$ in. width, is also available, and can be employed for marking out gangways and indicating work flow. Details of the service for the preparation of model layouts offered by the company are also given in the handbook, and models of special machines are shown.



Examples of Model Machine Tools Employed to Facilitate Factory Planning

Machine Tool Alignment Recorder

By C. TIMMS, D.Eng., M.I.Mech.E., M.I.Prod.E., and T. W. AITCHISON, Dip.R.T.C., A.M.I.E.E.*

An instrument† has been developed by the Mechanical Engineering Research Laboratory, East Kilbride, to record, continuously, the errors in alignment of the hob saddle motion of gear hobbing machines. The use of a ground cylindrical test pillar for determining errors in alignment of hob saddle traverse has been standard practice for many years. In the vertical type of machine, the test pillar is located centrally on the machine table, and errors in alignment are indicated by two dial gauges attached to the end of an extension bracket rigidly connected to the saddle. Difficulties with this method of measurement arise on large machines used for cutting marine reduction wheels up to 15 ft. diameter, because of the flexibility of the extension brackets, which may be as long as 6 ft.

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† Brief details were given of this instrument in MACHINERY 93/199-23/7/58, in an article dealing with the recent Open Days at the M.E.R.L.

To overcome these difficulties, a photo-electric gauging unit has been developed which records, continuously, the errors in alignment relative to a vertical reference wire, freely suspended from some convenient point on the machine under test. A sine-arm corrector bar is incorporated in the measuring unit, and moves, under magstrip control, in synchronism with the hob saddle traverse, in such a way that a correction can be automatically added to the pick-up signal to compensate for the fact that the table-axis may not be truly vertical, the inclination of the table axis having previously been determined by means of a sensitive level located on the machine table. In this way, the record obtained from the instrument can be arranged to indicate the true alignment between the hob saddle traverse and the table axis.

This new technique has the advantage that measurements can be made in close proximity to the cutting zone of the hob and can be applied with equal facility to all sizes of machine of the vertical design. The sensitivity of the measuring system is such that variations of the order of 0.0001 in. can be readily detected, which is essential in order to meet Grade A requirements of B.S. 1498:1954 (Gear Hobbing Machines for Turbines and Similar Drives).

THE MEASURING HEAD

Fig. 1 shows a general view of the measuring head. It consists of a gauging unit A and a computing element located on the base plate B which, in turn, is mounted in trunnion bearings forming part of the support bracket C, bolted to the hob saddle of the machine under test. This arrangement allows the gauging unit, with the computing element, to be rotated through 90 deg. so that measurements may be made in both the transverse and longitudinal planes in accordance with the requirements of B.S. 1498.

The gauge A is suspended from a bracket on the base plate by a pair of flat parallel springs D. This arrangement permits the lateral position of the gauge relative to the wire E to be controlled by the computing element through the extension arm F, attached to the gauge. A cross-slide, located on the base of the parallel spring assembly and carrying the gauging unit, enables the initial adjust-

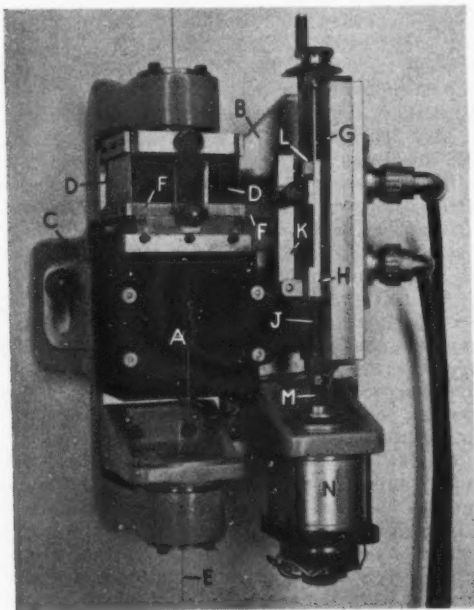


Fig. 1. The Measuring Head of the Machine Tool Alignment Recorder Developed by the M.E.R.L.

ment of the gauge, relative to the wire, readily to be carried out.

The computing element consists of a vertical slideway *G*, in which the carriage *H* is traversed by means of a 40 t.p.i. micrometer screw *J*. Mounted on the carriage is a sine bar *K*, pivoted at its lower end and having provision for clamping a slip pile *L*, at its upper end. The micrometer screw is connected, through a rubber coupling *M*, to a synchronous link magstrip *N*, which is connected electrically to a similar magstrip driven by the feed screw of the machine under test. Thus the two feed screws rotate in synchronism, and the displacement transmitted to the gauge *A* by the sine bar is directly proportional to the traverse of the machine saddle.

This effect could also have been achieved by the use of a fixed sine bar attached to the machine column. However, a sine bar at least 3 ft. long would have been required to cover the saddle traverse length, and this was obviously impractical. The use of a synchronized, fine-pitch screw effectively reduces the length of sine bar necessary in the ratio of the pitches of the two lead screws. The 40 t.p.i. micrometer screw, in conjunction with the 2 t.p.i. lead screw, common to most large machines, allows the 3-in. sine bar to cover a saddle traverse of 5 ft. The operating face of the sine bar on which the ball-ended extension bracket of the gauge head runs is relieved at the ends to leave a 3-in. long surface. Consequently, the start and finish of the 5 ft. traverse length can be identified on the chart record.

Fig. 2 and 3 show the inside of the gauging unit *A*. The slit is illuminated by the light source consisting of a Class G projection lamp and a collimating lens. The wire, which is disposed vertically down the major axis of the slit, splits the

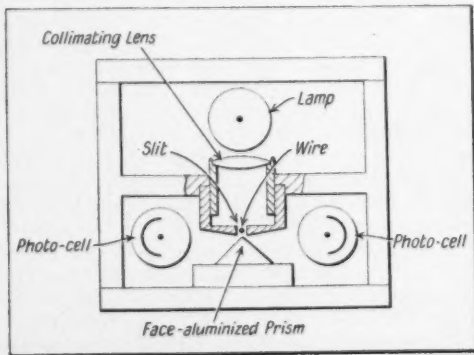


Fig. 2. Diagram Showing the Principle of the Gauge Head

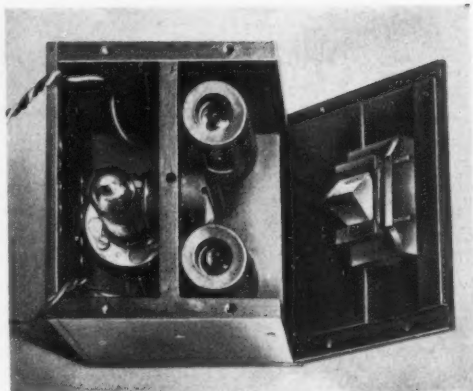


Fig. 3. View of the Gauge Head with Covers Removed

light into two beams in which the ratio of the light fluxes is a measure of the position of the wire in the transverse plane of the slit. The surface-aluminized prism immediately behind the slit separates the beams and reflects them on to the two photo-cells. As can be seen from Fig. 4, the photo-cells form two arms of a bridge circuit, the other two arms of which are fixed resistors forming the loads of the cells. The variable centre-tap of the fixed arms gives a zero adjustment which is useful in setting-up. The bridge is supplied with a D.C. potential suitable for the photo-cells, and the unbalance output voltage is fed to the grids of a double triode which is connected as a push-pull cathode follower output stage.† The pen recorder driving coil, which forms the load on this stage, has a variable resistor in series with it as a gain or magnification control.

All the power supplies for the gauge, including the lamp, are derived from the mains through a constant voltage transformer, to ensure stability against mains voltage fluctuations. The 50 volts required to energize the two synchronous link elements come from a separate transformer mounted in the instrument case.

Originally, it was thought that the vertical wire would pose no problems and 28 s.w.g. phosphor bronze wire was used with a loading mass of 12 lb. However, after a few tests had been made with the complete equipment, some spurious errors were observed which were attributed to non-straightness of the wire. This lack of straightness was verified by making two tests between which

† Vacuum Tube Amplifiers—Valley & Wallman, page 453.

the wire was rotated through 180 deg., when the observed spurious errors were found to be mirror-imaged on the two records. A series of tests was then carried out, using a number of wires available, and the best results were obtained from an electrical resistance wire, known as Minalpha. This wire was precision drawn, which accounted for its straightness, and, since its mechanical properties were fairly well suited for the purpose and it was immediately available, it was retained.

In use, the wire is fixed to a support, overhanging the top of the column, by means of a clamp which allows the wire to be rotated as required. The loading mass is attached to the free end of the wire and immersed in oil in a pot.

PERFORMANCE

The three main performance factors to be considered are (1) sensitivity, (2) linearity, and (3) stability. In addition to these factors, the effects of vibration, lack of straightness in the wire, and errors in the mechanical computing element are considered here, and the results of tests made on machine tools are also presented and discussed.

SENSITIVITY AND LINEARITY—Fig. 5 shows the output displacement characteristic of the gauge. The change of slope at both ends is due to the nose of the beam-separating prism being uncovered by the wire when the relative displacement from the balance point is half the wire diameter. A linear working range, approximately equal to the wire diameter is thus available. However, the pen recorder movement has a fixed working range of 0 to 1 milliamp, which must fall in the linear por-

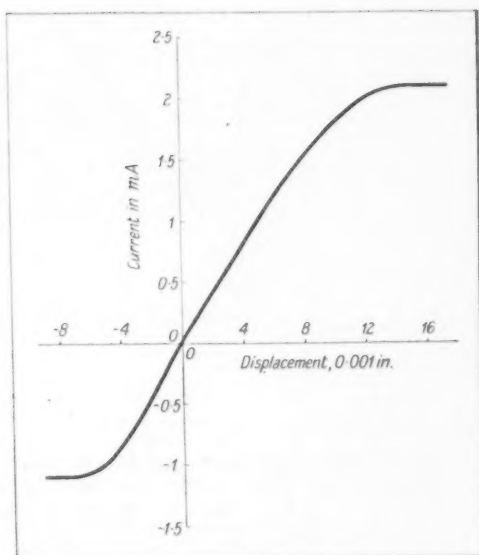


Fig. 5. Output-Displacement Characteristics of the Gauge

tion of the gauge output, and, to ensure the best linearity, in the centre of it. This requirement is met by altering the position of the nose of the prism relative to the slit, when the whole characteristic can be shifted as required.

The sensitivity of the gauge depends mainly on the photo-cell sensitivity, the current gain of the output stage being variable within the range 0.83 to 1.25. Overall linear magnification of the gauge ranges from 500 to 750 \times , and the normal operating magnification is 600, the full scale deflection of the recorder chart then representing a displacement of 0.005 in.

Under these conditions, the linearity of the gauge over the working range shows deviations of 0.00007 in. Since the errors to be measured normally do not exceed 0.002 in., the recordings

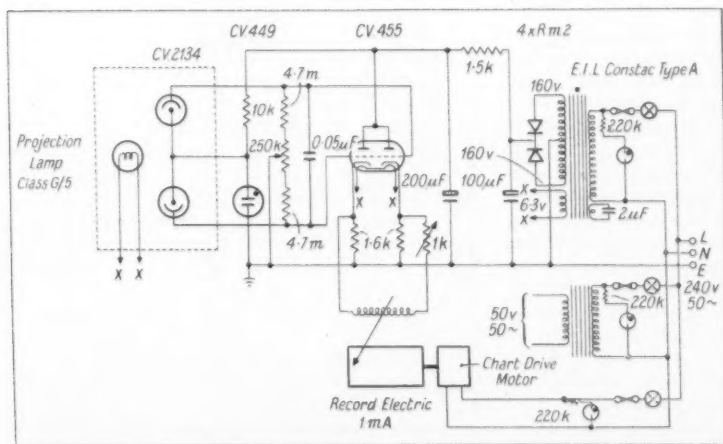


Fig. 4. Electrical Circuit Diagram of the Alignment Recorder

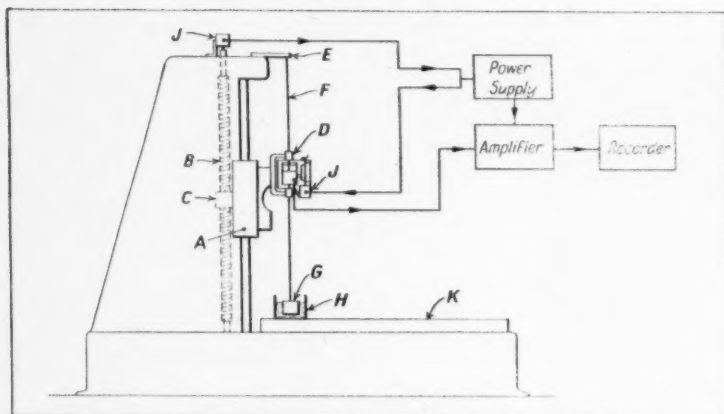


Fig. 6. Application of the Equipment to a Gear Hobbing Machine: A—Saddle, B—Feed Screw, C—Nut, D—Measuring Head, E—Wire Support, F—Wire, G—Loading Mass, H—Oil Pot, J—Mag-slip, K—Work Table

can be restricted to the central 0.003 in. of the chart, over which the deviations from linearity do not exceed 0.00004 in.

STABILITY—Since the equipment is used in temperature-controlled machine shops, errors due to temperature variations are negligible and the main source of drift is mains voltage fluctuations. The effect of these fluctuations is reduced by the constant-voltage transformer. A chart record taken with the equipment set up as for normal operation, but with a wire fixed relative to the gauge head, showed the drift over a period of 30 min. to be less than 0.00003 in.

VIBRATION—Vibration, whether produced by the saddle traverse mechanisms of the machine under test, or transmitted through the floor from other machines, causes the vertical reference wire to vibrate in sympathy and in a mode dependent on the frequency of the forcing vibration. If the amplitude of the wire vibration is large enough to uncover the nose of the prism, serious errors arise. However, vibrations of this magnitude have not been encountered in practice, and any vibration present merely causes an A.C. component at the bridge output which is subsequently filtered out at the output stage by the .05 micro-farad capacitor.

OTHER SOURCES OF ERROR—Lack of straightness in the reference wire can be a source of error but the use of precision drawn wire, stretched *in situ*, results in errors not exceeding 0.00005 in. The detection and elimination of errors from this source, however, can be achieved by obtaining two records with the wire rotated through 180 deg. between

the first and second, and taking the mean.

The linearity of the mechanical computing element is affected by non-straightness of the slide and lack of flatness in the working surface of the sine bar. The total error from these sources was found to be less than 0.00003 in.

OPERATION OF THE EQUIPMENT

In Fig. 6, the equipment is shown fitted to a gear hobbing machine. The reference wire is fixed to a short outrigger, attached to the top of the machine column, and arranged to pass through the cutting zone of the hob. A loading mass is fixed to the free end of the wire and immersed in the oil pot, the wire then being stretched to improve its straightness. With the head unit bolted to the machine saddle, it is levelled and adjusted so that the wire passes through the slit. The synchronous link transmitter element is so mounted as to engage with the top end of the

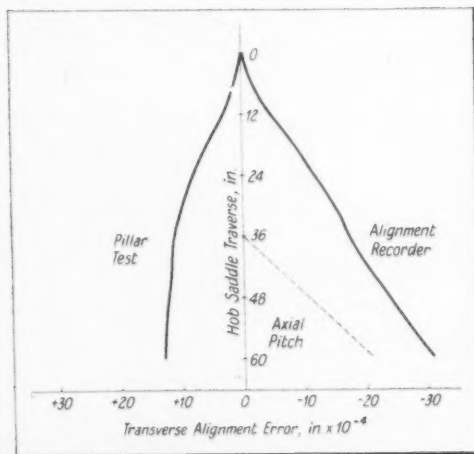


Fig. 7. Comparison of Alignment Error Results Obtained from a Pillar Test and from the M.E.R.L. Alignment Recorder Equipment

machine lead screw. The amplifier and recorder unit is placed conveniently near the machine, and the interconnecting cables are plugged in and arranged to fall clear of moving parts, being taped where necessary. After switching on and allowing 30 min. for warming up, the magnification control is adjusted so that incremental deflections of the gauge head relative to the wire result in pen deflections on the chart recorder of amplitudes consistent with good linearity. The most accurate and convenient method of imparting the necessary deflection to the gauge head is by means of the sine bar corrector unit. If a slip pile, differing by 0.012 in. from that which produces no correction, is inserted under the end of the sine bar, then each turn of the micrometer screw moves the gauge head 0.0001 in. In addition, out-of-level of the machine table is measured accurately in both transverse and longitudinal planes, using a precision spirit level. The inclination of the sine bar is then adjusted, by means of slip gauges, in order to compensate for the measured error in table-level. Recorded results then show the error in alignment relative to the position of the table-axis.

TEST RESULTS

The instrument has been used to measure the alignment errors of a number of gear hobbing machines, and some results for the transverse plane of a wheel machine are shown in Fig. 7, together with the corresponding results obtained from a pillar test. The discrepancy between the two sets of results is quite marked and the question arises as to which is more accurate. One practical check is to compare the alignment error with the error in axial pitch measured on a wheel cut on the machine, since the major portion of this error is due to transverse alignment error. The dotted line in Fig. 7 shows the measured axial pitch error, expressed as the corresponding alignment error, which is obviously more consistent with the results obtained from the alignment recorder.

The discrepancy between the two sets of alignment error results can only be attributed to the shortcomings of the pillar test, i.e. the errors introduced into the readings by wind and twist of the hob saddle which is communicated to the dial indicators through, and amplified by, the long extension arms or brackets.

Of great importance in the measurement of errors in large machine tools are the warming-up effects. These effects are demonstrated by Fig. 8, which shows the transverse alignment errors measured at various times after starting the machine up from cold. It is interesting to note that, on this particular

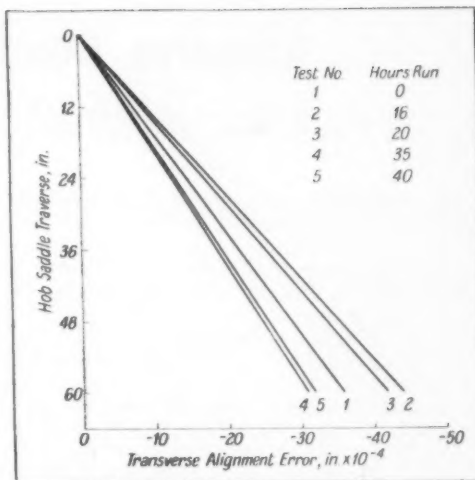


Fig. 8. Effect of Machine Warming-up on Alignment Error

machine, the shift of the alignment is not always in the same direction, and this was confirmed by a second series of tests. However, the main point to note is that changes in the machine take place as heat from bearings, drives and motors, spreads, and, in most cases, at least 48 hours running is necessary before these effects stabilize. Only then can measurements be made which will indicate the performance under operating conditions.

CONCLUSIONS

The equipment that has been described is capable of making completely autographic tests on a gear hobbing machine in the normal cutting zone of the hob with an accuracy of 0.0001 in. Although the equipment has been developed and described with reference to gear hobbing machines, it can be used to measure the alignment of nominally vertical motions on any machine tool. Slight modifications to the operational technique may be called for, and in extreme cases modifications to the mechanical arrangement of the head unit may be necessary.

THE PRODUCTION OF TIN METAL during the first quarter of this year reached a total of 9,580 tons, of which 4,870 tons were for home consumption. In the first quarter of last year, the corresponding figures were 8,140 and 5,950 tons, respectively.

Adhesive Bonding of Metals in Aircraft Production

A recent Bulletin (No. 184) published by CIBA (A.R.L.), Ltd., Duxford, Cambridge, contains a reprint of an article, which was originally published in *Luftfahrttechnik*, Vol. 3, No. 3, describing the use of the Redux process for the adhesive bonding of airframe components. The article is concerned with the methods employed by the Fokker company of Holland, and was written by Mr. R. J. Schliekelmann, chief of the company's Production Research Department. After discussing the use of adhesives for the early wooden aircraft made by the firm, the article, which is well illustrated, describes the advantages, from the standpoints of production and subsequent operation, of metal aircraft with adhesive-bonded structures. In planning manufacturing sequences, it is comparatively easy to assess the relative merits of riveting and adhesive-bonding. The larger the components which can be bonded in one operation, the greater the economies gained from the use of adhesive.

Where joints which are proof against air or liquid leakage are required, as in pressurized cabins or fuel tanks, adhesives give very favourable results. Among the operational advantages gained from the use of adhesive bonding are reductions in air resistance and weight of structure. Research carried out by the company has shown that the bonding process permits increases in mechanical strength under conditions of both static and alternating loading.

It is stated that a good riveted joint between two pieces of duralumin 24ST, of the thickness normally employed in aircraft, will never give a shear strength of more than about 1.8 kg. per sq. mm. of overlapping surface, and that the value is usually lower. Redux-bonded joints frequently give at least equal, and sometimes better results.

Because of the good shear strength of Redux adhesives, it is possible to build up the thickness of a skin panel in proportion to the local load by superimposing several layers of material. By the use of simple equipment, better results can be obtained than by expensive milling methods and the ideal of a uniform stress distribution in a structure can be approached. At the same time, stress raising rivet holes are avoided, and longer fatigue life is ensured. Among aircraft components in which advantage has been taken of the possibilities of building up thicknesses at heavily-loaded points

are mentioned the roots of helicopter blades, wing skin panels, pressurized cabin structures, and wing and other spars.

Tests in which riveted and bonded stringer-reinforced panels were subjected to compression loads showed that, for a bonded panel, failure occurred at 23 per cent higher load than that for an equivalent riveted panel. Comparative tests by British companies are also quoted, and similar tests carried out on complete fuselage structures for the Fokker Friendship commercial aircraft gave further evidence of the stabilizing effect of the bonded joints. The bonded wing structure of a Fokker S-12 training aircraft was subjected to a fatigue test corresponding to about 30,000 flying hours under severe strain, and was then loaded statically until fracture occurred. It was found that all the bonded joints had held, whereas numerous cracks and fractures, accompanied by severe plastic deformation, occurred when a riveted structure was similarly tested.

Redux adhesive comprises a powder and a liquid component and during the curing process some of the powder is dissolved in the liquid and the whole layer is compressed. The resulting film of adhesive is neither porous nor homogeneous but is said to be superior to homogeneous plastics in resisting cracking, and to have excellent adherence to the work surfaces, provided that they have been properly cleaned. Surfaces should preferably be prepared by etching with chromic acid, and the adhesive is then applied before contamination can occur. Parts can then be stored until required for bonding.

Where a number of layers of different shapes are to be bonded, fairly complex jigs are required, and they are usually made from light alloy to ensure even transmission of heat from the press platens. Uniform heating of the plates to be joined is essential if stresses in the completed assembly are to be avoided, and the cooling rate must be maintained as evenly as possible throughout the structure.

Test samples accompany each batch of components through all the cleaning and glueing processes and are tested by a peeling technique before the batch is finally glued. After curing, the thickness of the glue line is measured to ascertain whether sufficient pressure has been applied.

New Production Equipment

Loudon 40- by 9- by 8½-ft. Heavy-duty Planing Machine

Fig. 1 shows the 40- by 9- by 8½-ft. heavy-duty planing machine which has recently been built at the Loudon Works, Johnstone, of the Scottish Machine Tool Corporation, Ltd., 17 Lynedoch Crescent, Glasgow, and supplied to the British Polar Engine Co., Ltd., Glasgow, for machining diesel engine bedplates. The machine is equipped for cross-, deep-, and radius-planing.

Drive is taken from an 80-h.p. motor through a 2-speed gearbox, and full power is available at fairly low table speeds, the latter ranging from 20 to 180 and 14 to 125 ft. per min. The double spiral drive is so arranged that six teeth on the rack worm are always in mesh with the rack beneath the table. Broad flat bedways, with inner lips, provide a long narrow guide for the table to ensure maintenance of accuracy. Both the bedways and rack worm are lubricated by an independently-driven pump which is interlocked with the main driving motor. The table is made

in two portions, which can be disconnected, so that work on one section can be planed while the other section is being loaded.

The close-up view in Fig. 2 shows the radius planing unit in position on the right-hand head for the standard toolbox. Drive for this unit is taken from the feed-shaft on the cross-slide, and each feed impulse produces a small angular movement of the rotary head. Tool relief is provided by a solenoid.

Additional attachments provide for deep end- and cross-planing, so that five sides of a cube, also transverse slots, can be planed at one setting of the work on the table. The end planing tool unit, which may be seen on the left-hand end of the cross-rail in Fig. 2, is traversed by the lower screw, which is of increased diameter. Drive for this motion is taken from a 20-h.p. variable-speed motor, which provides cutting speeds from 10 to 50 ft. per min., with return speeds up to 80 ft. per min. The electrical controls are interlocked with those of the main driving motor so that the two motions cannot be engaged simul-

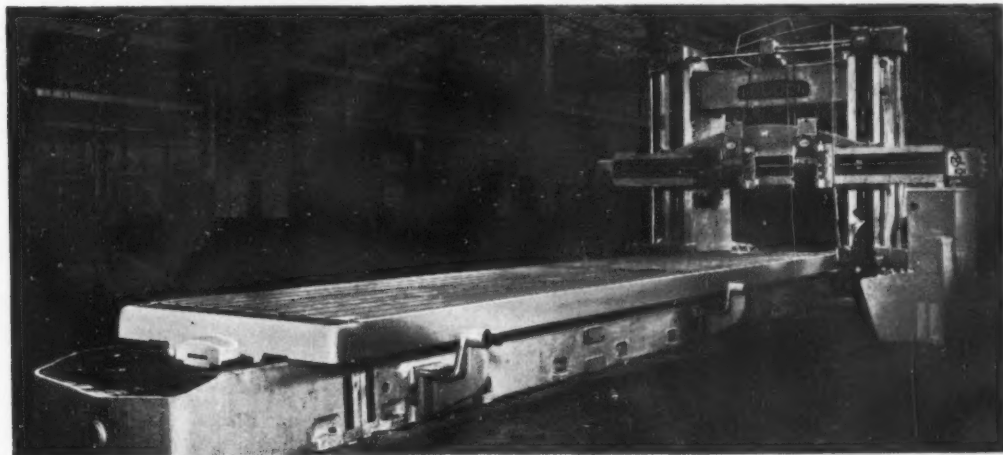


Fig. 1. Loudon 40- by 9- by 8½-ft. Heavy-duty Planing Machine



Fig. 2. Close-up View of the Cross-rail on the Loudon Planing Machine, Showing the Radius-planing and Deep End-planing Tool-boxes

taneously. For deep end- and cross-planing operations, the table is locked in position by means of clamping bolts carried in substantial brackets mounted on the side of the bed, as seen in Fig. 1.

The feed drive is taken from an electronically-controlled motor, which provides horizontal and vertical feeds to all the tool-boxes, also vertical feeds to the cross-slide for deep end planing. This motor also provides rapid power traverses to the tool-boxes and cross-rail. Push-buttons on the pendant control the principal motions of the machine, and selection switches are provided on the control desk, which is so located that the operator has a clear view of the work and tools.

Archdale 20-in. Horizontal Milling Machine with Automatic Cycle Control

The No. 14670 20-in., horizontal milling machine made by James Archdale & Co., Ltd., Ledsam Street, Birmingham, 16, can now be supplied to perform either a single or a repeating automatic table cycle. A general view of the machine in the latest form is given in Fig. 1, and a close-up view of the table controls, with covers removed, is shown in Fig. 2.

With the original design, it is necessary for the operator to hold the control lever outwards to maintain the rapid traverse movements of the table, and the direction of traverse is reversed by means

of the same lever. With the alternative arrangement that has now been introduced, one or more cycles, up to a maximum of 20, can be performed with a minimum of attendance. The operator starts the spindle and table by push-button and can then leave the machine to continue to the end of its cycle, or cycles, at which point both spindle and table will come to rest. By the use of suitable automatic indexing fixtures, one operator can thus tend two or more machines.

When the start button is depressed, the spindle is driven and the table approaches to a point just clear of the work at the rate of 150 in. per min. A dog on the table then switches off the quick traverse motor and the table motion continues at the previously-selected rate. On completion of the feed traverse, a dog causes the table to reverse accurately at feed rate, whereupon the quick return motion of 150 in. per min. is engaged. With single cycle operation, this speed is maintained until the table is stopped automatically at the loading position. When a repeating cycle has

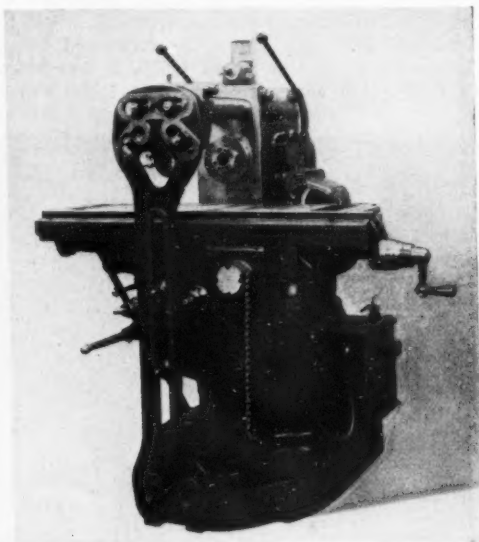


Fig. 1. Archdale 20-in. Horizontal Milling Machine which can be Set to Perform a Single or a Repeating Automatic Table Cycle

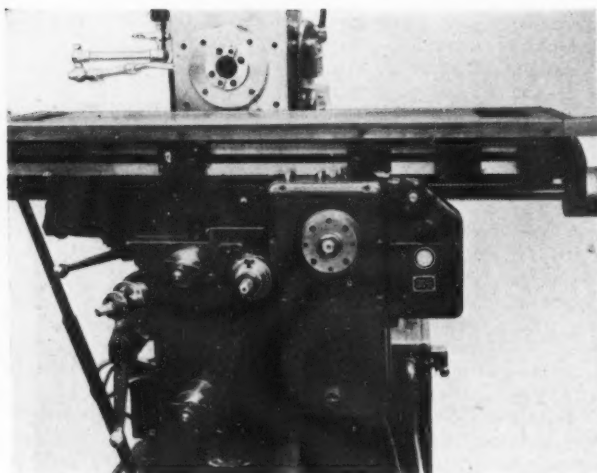


Fig. 2. Close-up View of the Table Controls, with Covers Removed, on the Archdale 20-in. Milling Machine

been arranged, the quick return is changed to feed rate just before the point of reversal, in order to reduce shock, after which the table traverses rapidly forward, and the cycle is repeated until the required number of passes has been made. The spindle continues to run throughout the sequence, and only stops when the table finally comes to rest. Gearing, located in a housing on the right of the control box, serves to predetermine the number of cycles, and provision is made on the control box for applying a handle, so that the table can be traversed by hand when setting up the machine.

May Twist Drill and Countersink Grinding Machine

In the accompanying illustration is shown the May SS 75A twist drill and countersink grinding machine, which is made by Rohde & Dörrenberg, Dusseldorf, Germany, and distributed in the United Kingdom by Kimbell Machine Tools, Ltd., 39 Victoria Street, London, S.W.1. The machine is designed for point grinding left- or right-hand spiral twist drills, and other 2-, 3- or 4-fluted cutters ranging from $\frac{1}{8}$ to 3 in. diameter. Drills may be ground to any centre point angle from 80 to 160 deg., and provision is made for producing special point forms, which have proved effective, for example, when drilling cast iron.

Within the pedestal casting of the machine is housed a 3-h.p. motor, and drive is transmitted by an endless flat belt, with suitable tensioning

arrangements, to the grinding wheel spindle, which normally runs at 2,250 r.p.m. A pendulum unit carries the wheel spindle, and an oscillating motion, imparted by gearing and engaged by a lever-operated clutch, is provided which ensures uniform wear on the wheel face.

The work-head unit can be set, by reference to a circular scale, to present the tool to the grinding wheel at the required angle. This unit incorporates clamping jaws specially shaped for gripping the ends on the spiral flutes of the tool, and a tail-stock centre for supporting the shank. An automatic oscillating motion is provided for the work-holder assembly, the drive being taken from a separate motor through gearing, and the arc of travel can be varied to suit tools with two, three, or four cutting edges. By adjustment of the work-holder, various relief angles can readily be produced on the tool.

The rate of feed is controlled by a handwheel, and, with the motor running, the tool is gradually



May SS 75A Twist Drill and Countersink Grinding Machine

brought into contact with the surface of the rotating grinding wheel as it swings on the pendulum mounting. Simultaneously, the oscillating motion is imparted to the work-holder to produce the required point form. After each cutting edge has been ground, the work is re-set in the jaws of the holder in order to present another edge, and this process is repeated, the tailstock setting remaining undisturbed, until all cutting edges on the tool have been sharpened.

The rate of stock removal is determined by the movement of the feed handwheel, which can be adjusted by the operator to remove as much as 0.125 in. of metal during a single roughing pass, if necessary.

An ample coolant supply is provided by a vane-type pump which is driven by a separate motor and housed in a reservoir, inside the pedestal. In this connection, it may be noted that the use of soda water coolant, which ensures improved grinding efficiency, is permissible, since there are no flat sliding ways on the machine that require oil lubrication.

A type 75 III May twist drill grinding machine is also available, which is of generally similar design, but is provided with a hand-operated fixture for oscillating the tool during sharpening.

Kampf Type FK3 Copy Milling Machine

In Fig. 1 is shown the type FK3 copy milling machine for operations on dies and moulds, recently introduced by the German firm of Michael Kampf, who are represented in this country by Embassy Machine & Tool Co., Ltd., 248 Watford Way, Hendon, London, N.W.4.

Unlike the type FK2a, which incorporates an adjustable pantograph linkage whereby reduced movement of the cutter head is obtained, the new machine is intended for reproducing 2- and 3-dimensional shapes in the ratio of 1 to 1 only. Adjustable independently for height, the cutter and stylus heads have a centre distance of 20 in., and are mounted on a compound slide, whereby they can be moved vertically simultaneously through a maximum distance of 3½ in., and traversed horizontally, by hand, in roller guideways on a substantial arm. This arm can be traversed at right-angles by hand on roller guideways, and the saddle on which it is mounted has an adjustment of 16½ in. on the column ways. A close-up view of the cutter and stylus heads is given in Fig. 2.

With this arrangement, the stylus pin and cutter spindle can be moved over a maximum area of 16 by 20 in. at a single setting of the work. Screw adjustments of 16½ in. longitudinally and 12 in.

transversely are provided for the 22- by 25-in. work and pattern tables, which enable the working range of the machine to be considerably extended. Since an unrestricted space is provided at the front and rear of the tables, workpieces of any length can be handled. The pattern table can be swivelled through angles up to 7½ deg. in each direction, in order to facilitate setting the pattern in line with the workpiece. Mounted in guideways in the well-ribbed box-section bed, which is cast integral with the column, the tables will each support loads up to 1½ tons, and can be adjusted vertically, through distances up to 12 in., by separate handwheels through large-diameter Acme screws. A maximum distance of 24 in. is obtainable between the nose end of the cutter spindle and the working surface of the table.

Drive to the cutter head is transmitted by belts, and the spindle speeds can be varied steplessly from 700 to 3,000 r.p.m. by means of a knob on the column, a dial instrument being provided to facilitate setting. The spindle nose has a No. 2 Morse taper bore, and will accommodate collets up to ½ in. capacity, the maximum diameter of milling cutter that can be employed being ¾ in. A No. 4 Morse taper bore is provided at the nose end of the stylus head, which will accommodate collets up to ¾ in. capacity. An electric blower is incorporated for the removal of cuttings from the working area and for cooling the cutter.

A shoulder grip is mounted on the right-hand end

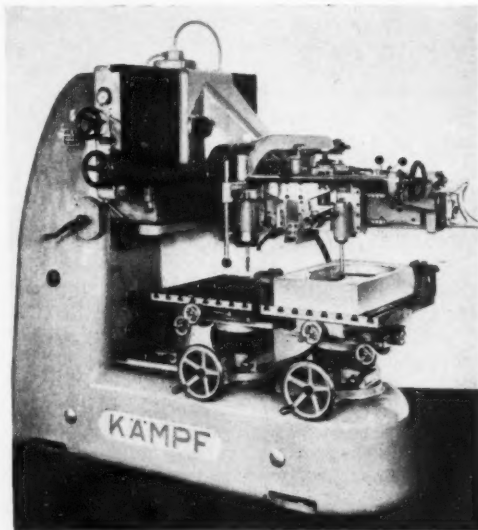


Fig. 1. Kampf Type FK3 Copy Milling Machine

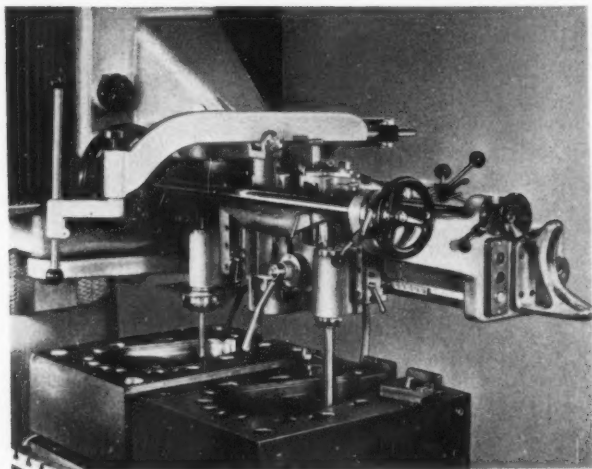


Fig. 2. A Close-up View of the Stylus and Cutter Heads

of the arm for use when heavy cuts are being taken on the work during rough-machining operations. Then, movement of the compound slide on the arm is effected by means of a star-wheel, at the rear, through a rack and pinion. Cross-movement of the saddle is obtained by a handwheel, through a shaft and a rack and pinion, or, when rapid travel is required, by rotation of a surrounding tubular shaft. The outer shaft is rotated by a second, large-diameter handwheel, which can be adjusted axially and secured in the required position. During rough-machining operations, down-feed is usually applied to the cutter and stylus heads by a screw, which is turned by a lever at the centre of the capstan handwheel, through a ratchet and pawl.

For taking finishing cuts on 3-dimensional shapes, the screw and nut for applying down feed is disengaged, so that the vertical slide can move freely under the control of the stylus pin. This slide is counterbalanced by a spring and a system of levers, which can be adjusted with the aid of a detachable crank, so that the contact pressure between the stylus pin and the pattern may be varied as required. Movement of the compound slide on the arm is then obtained by a long lever, which is pivoted at the rear end and is connected to the vertical slide by a swivel joint, so that it can move freely with the cutter and stylus heads. Cross-travel of the arm on the saddle is effected by the large-diameter handwheel.

Since the compound slide and the arm run in roller guideways, very sensitive movements are

obtained, and, consequently, intricate shapes can be readily machined. This feature is of particular importance when certain 2-dimensional forms are being produced. Owing to the fact that movements of the cutter and stylus heads in the horizontal plane are controlled by hand, the pattern of cuts taken on the work when 3-dimensional shapes are being machined, can be arranged to follow the contours of the workpiece, so that subsequent hand finishing is reduced to a minimum. With this method, moreover, idle movements are reduced, so that the shortest possible cutting cycle is obtained.

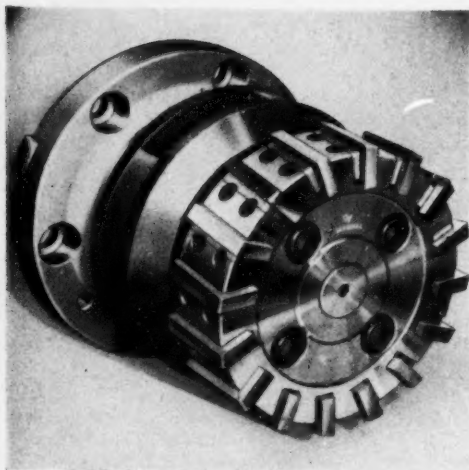
If required, 3-dimensional shapes can be reproduced by successive straight-line cuts. For this technique, the free movement of the arm on the cross-slide, is reduced by means of a knob-operated clamp, or, alternatively, the compound slide is connected to a traversing screw by half nuts. Cuts are then taken on the work by horizontal movement of the unrestrained slide, the vertical travel of the cutter slide being controlled by engagement between the stylus pin and the pattern. At the end of each pass, an increment of cross feed is applied to the cutter and stylus heads by a lever-operated ratchet and pawl mechanism. Alternatively, a stop attachment can be fitted which causes the cross feed to be applied automatically in steps ranging from 0.002 to 0.02 in.

The machine weighs approximately 2 tons 12 cwt., and occupies a floor space of 98 by 55 in. A machine of similar design but smaller capacity will be available shortly.

Clare Size G Collet Chuck

The range of milling equipment made by Clare Collets, Ltd., Wright Street, Broadheath, Altrincham, has recently been extended to include a size G collet chuck, which is here shown fitted with an 8-in. diameter inserted-blade, face-milling cutter.

Intended for use on large-capacity milling, and boring machines, the new chuck will accommodate a wide variety of cutters, with parallel shanks up to 3 in. diameter, and 5-in. diameter direct core shanks for mounting into the chuck body without the use of a collet. It is designed for fixing, by means of screws, to spindles with 5- $\frac{1}{8}$ -in. diameter B.S.S. nose ends, which have 7- $\frac{1}{2}$ -, 7- $\frac{1}{4}$ - and 10-in. diameter flanges, and is capable of trans-



Clare Size G Collet Chuck Fitted with an 8-in. Diameter Face-milling Cutter

mitting torques up to 5,400 lb. ft. Collets with 1½-, 2-, 2½- and 3-in. bores, also sleeves to take No. 5 Morse taper shanks are provided. A reducer chuck is also supplied which can be accommodated in the bore of the largest collet, and will take collets for ¼- to 1½-in. diameter parallel shanks and for No. 2, 3 and 4 Morse taper shanks.

As an indication of the gripping capacity of the chuck, it is stated that, during one milling operation, a 12-in. wide by ¼-in. deep cut was taken on the work at a feed rate of 14 in. per min. by a 14-in. diameter tungsten-carbide tipped cutter, corresponding to a metal removal rate of 35 cu. in. per min. The power input to the cutter was 25 h.p.

The G-size chuck can also be used for holding the work on gear-cutting machines.

Sciaky BSF.1 Bench Spot-welding Machine

A view of the operating side of a new precision bench spot-welding machine, which has been introduced by Sciaky Electric Welding Machines, Ltd., Falmouth Road, Slough, Bucks., is shown in the accompanying Fig. 1. This machine is intended for extremely fine work, such as electronic valve components, filament wires, electrical contacts, and thermo-couples, also certain watch, jewellery, and spectacle parts. Thyatron valves are employed to control the switching of the primary current, and an electronic phase shift is used, in conjunction with these valves, to provide a stepless-adjustment of the welding current. The equipment also incor-

porates a dekatron-type electronic timing control, on which a visual indication of the welding period is given, and this period can be varied, in steps, from half a cycle to nine cycles.

As can be seen in Fig. 1, the electronic control equipment, which is of Sciaky design and manufacture, is housed in a sliding compartment at the right, arranged for ease of inspection and maintenance. There are four tappings for the coarse heat settings, and the phase shift, which provides a Vernier heat adjustment for critical work, is used to obtain precision weld settings. It is stated that with this machine the heat required to effect the weld can be adjusted to the minimum, in order to reduce distortion and discoloration of very small parts.

A close-up view of the welding head and bench top is given in Fig. 2. Electrode force is applied through adjustable springs, compressed by the pedal seen in the knee-hole compartment in Fig. 1, and the precise adjustment which is provided allows the required pressure to be set within a few ounces. The flat, stove-enamelled bench top is easily cleaned, and affords ample room for storage racks and containers for the small pieces to be welded.

Universal-type electrode holders are used, and an adjustment is provided for setting the gap between the tips so that clearance can be obtained for deep-flanged components.

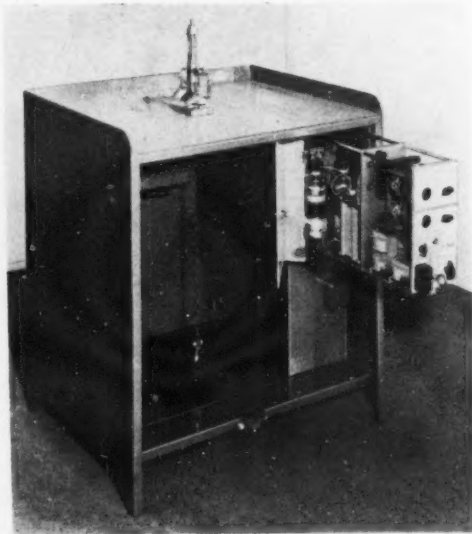


Fig. 1. Sciaky BSF.1 Bench Spot-welding Machine

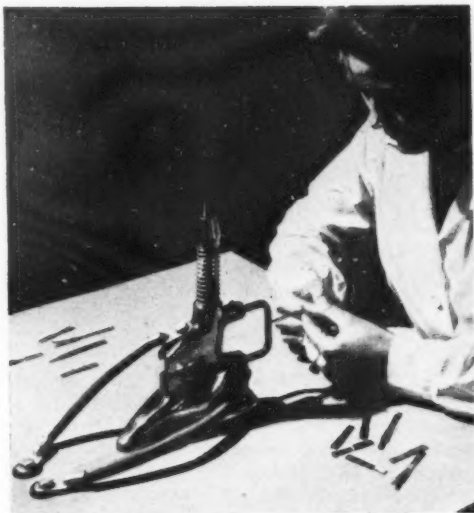


Fig. 2. Close-up View of the Welding-head and Work-table of the Sciaky BSF.1 Spot-welding Machine seen in Fig. 1

This equipment can be supplied with transformers of 1, 2, or 5 kVA. nominal ratings, and with welding heads covering a range of electrode forces.

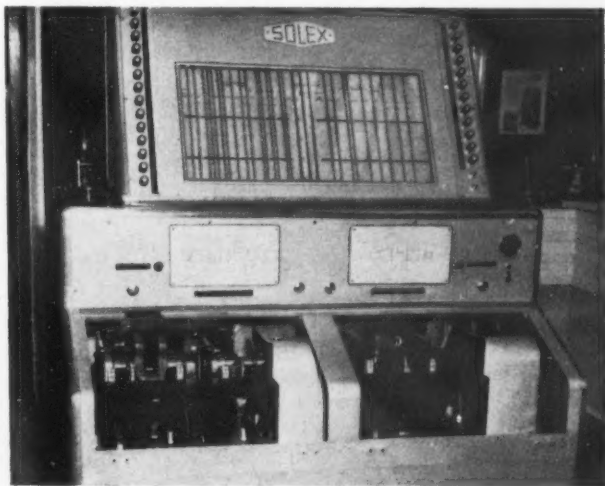
Solex Automatic Inspection Machine for Crankshafts

Among the exhibits on the stand of Solex (Gauges), Ltd., 72 Chiswick High Road, London, W.4, at the recent Gauge and Tool Exhibition was an automatic 28-column machine, shown in the accompanying illustration, for the inspection of diesel engine crankshafts. The machine provides for the inspection of 2-throw and single-throw shafts in the left and right-hand sides of the cabinet respectively. On a 2-throw shaft, a total of eight different diameters is measured, including three main and two crankpin bearings, and eight length measurements are also taken from a common datum face adjacent to the main bearing at the flywheel end. Five diameters are checked on single-throw shafts, including those of

three bearings, and four length measurements are taken, again from a common datum face. After placing a shaft in position on loading bars above cavities at the front of the cabinet, and pressing two widely-separated buttons to initiate the automatic cycle, the sequence of operations is performed entirely automatically, and the shaft is returned on the loading bars for removal.

Guides are fitted in the opening above the loading bars to ensure that the shaft has been turned to bring the crankpins to the correct positions to enter the caliper-type diameter-measuring units when the shaft is lowered on the bars, which are operated by air cylinders. When the shaft has been moved down into the measuring position, in which it rests on V-locations, and engaged with the calipers and other measuring units, a driving chuck, turned by a motor in the cabinet base, is advanced from the central position and engaged with the end of the shaft. By this means, the shaft is slowly turned while the operator watches the levels of the liquid in the manometer tubes which indicate variations from the master dimensions. The measuring heads in the cabinet are selected so that the various limits imposed can be indicated by straight lines which cross all the manometer tubes. As a result, the inspection operation is simplified, and the risk of mistakes is reduced.

Adjustment of the measuring heads to the master shaft is effected by means of the rows of buttons on each side of the enclosure for the manometer tubes. The unit incorporates the newly-introduced



This Solex Machine is Designed for the Automatic Inspection of Two Types of Diesel Engine Crankshafts

Solex system for automatically topping up the water in the tubes, so that the minimum of adjustment is required.

Schaublin Capstan Lathe with Hydro-pneumatic Control

The Swiss firm of Schaublin S.A. have introduced the capstan lathe shown in Fig. 1, which is equipped with hydro-pneumatic controls whereby it can be operated on a semi- or full-automatic cycle. The machine is particularly suitable for second operation work, and several machines can be tended by one operator. A bar feed mechanism can be fitted, which, in conjunction with the fully-automatic operation, allows small batch quantities to be machined. Known as the type 102 H.P., it has a centre height of 4 in., and collets of $\frac{3}{8}$ - or $1\frac{1}{4}$ -in. capacity can be fitted. The maximum clearance between the spindle nose and the turret is $11\frac{1}{2}$ in., and the 6-position turret has a working stroke of 2 in.

The hydro-pneumatic system, which is operated from the shop air line, provides for the automatic operation of the following functions: rapid approach; feed and rapid return, or feed return, of the turret slide; turret indexing; operation of the

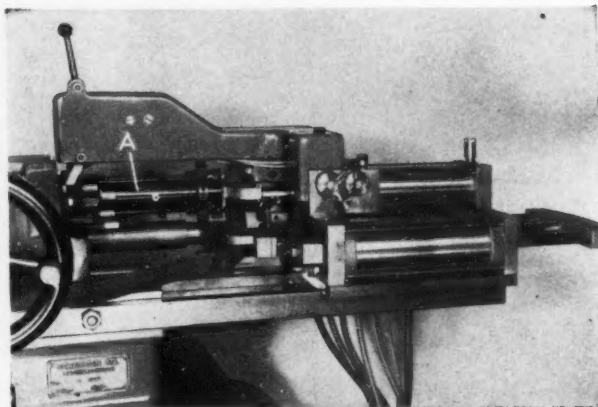


Fig. 2. Close-up View of the Control Unit of the Schaublin 102 H.P. Capstan Lathe

cut-off or plunge-cut slide; collet opening and closing; bar feed; stopping of the machine when the bar has been used up; change of spindle speed; reversal of spindle rotation; and operation of the coolant system.

The close-up view, Fig. 2, shows the control unit and the hydraulically-controlled air cylinders for the turret slide movement. Located to the rear of the turret centre-line is the indexing drum A, which is driven by spur gears from the turret indexing motion. This drum carries adjustable stop screws for controlling the feed rate, which is steplessly-variable up to 47% in. per min. and is independent for each turret position. The rapid traverse rate can be varied from 196 to 276 in. per min. Adjustable positive stop screws are provided to limit the length of stroke for each turret position as on a standard turret lathe.

The opening and closing of the collet is effected by means of a simple lever system actuated by an air cylinder, and the overhead cut-off slide is operated from the main hydro-pneumatic system, the

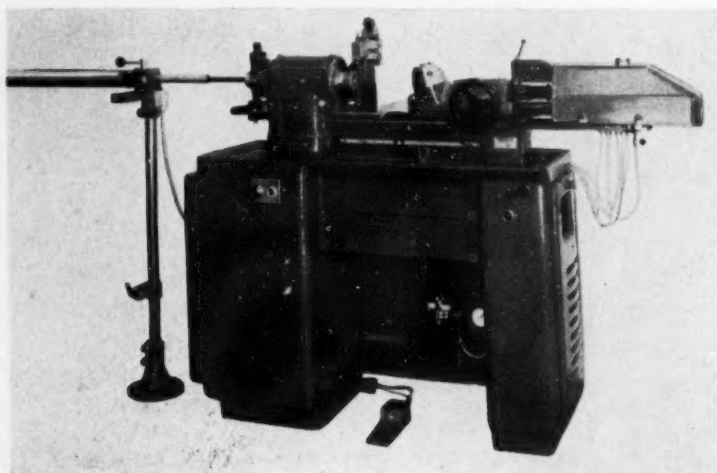


Fig. 1. Schaublin Type 102 HP Hydro-pneumatically Operated Capstan Lathe

control mechanism being mounted at the back of the headstock. When the machine is working on a fully-automatic cycle, the consumption of air varies between 105 and 282 cu. ft. per hour.

The sole agents for Schaublin machine tools in this country are Wickman, Ltd., Factored Machine Tool Division, Fletchamstead Highway, Coventry.

Strojexport Guillotine Shear

F. J. Edwards, Ltd., 359-361 Euston Road, London, N.W.1, are the sole agents in this country for the Czechoslovakian-built Strojexport guillotine shear shown in the illustration.

This shear has a capacity for cutting mild steel plates up to $\frac{3}{4}$ in. thick by 8 ft. 4 in. wide, and the distance between the side members of the frame is 9 ft. The gaps in the side members are 10 in. deep. Drive to the crankshaft is transmitted by V-belts and a disc-type clutch, and, finally, by triple-reduction gearing, which gives an operating speed of 10 strokes per min. Engagement and disengagement of the clutch is effected by a lever, which may be secured in the working position to provide for continuous operation. When the clutch is disengaged, a brake is automatically brought into use and ensures that the shearing blade is stopped at the top of its stroke.

Hydraulically-operated hold-down clamps are automatically applied at the beginning of the working cycle, and three rolls, which can be adjusted lengthwise in a T-slot at the front of the bed, are provided for supporting heavy plates. The connecting rods can be adjusted vertically for

varying the shearing angle of the guillotine blade.

Adjustable front, rear and side work stops are fitted. The rear stop, which can be swivelled, is adjusted by handwheel through rack and pinion, and may be set for taking parallel cuts at spacings up to 26 in.

The shear weighs 18 tons 4 cwt., and occupies a floor space of 13 ft. 2 in. by 9 ft. 7 in.

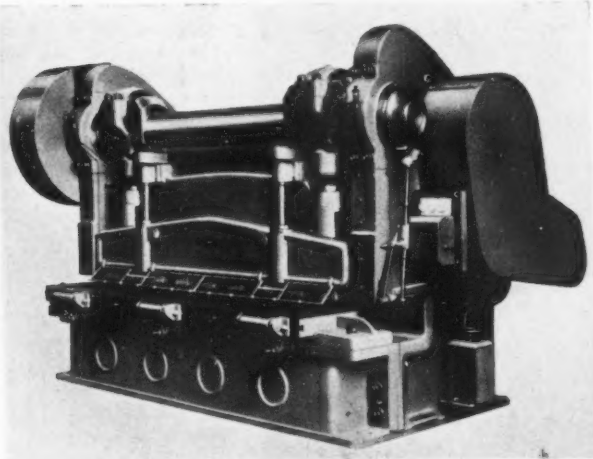
T-SECTION CAST ALUMINIUM INGOTS—To facilitate the handling of large cast aluminium ingots, the Aluminum Company of Canada, Ltd., are now producing them in a T-section. At present, according to *Aluminium News*, the ingots are cast in two sizes, with weights of 750 and 1,500 lb., and leg heights of the tees 3 in. and 4 in., respectively.

The cast ingots are stacked with the leg of the tee downwards, and may readily be picked up by inserting the forks of a conventional fork-lift truck beneath the shoulders of the head of the T. The ingots are precision cast, by the direct chill method, which provides good flat faces at the head and the foot of the T, and enables them to be stacked with safety.

A total of ten of the larger, and 15 of the smaller, ingots can be stacked, the main limitation being the height at which the fork-lift truck can operate. It is stated that the saving in storage area which can be effected with ingots of this design can range from 30 to 80 per cent, according to the height to which they are stacked.

It is also claimed that this cross-section reduces the possibility of trapping moisture and contamination beneath the ingot surface, the quality of the melted metal being consequently improved, and, furthermore, reducing the risk of explosions taking place in the furnace.

There are various methods of charging ingots into a furnace, for melting, and one of the most common is by the use of a fork-lift truck. This system has disadvantages, however, including the possibility of the metal splashing as the ingot enters the furnace, also the fact that wear can take place on the refractory door stills and the hearth. One method which has proved satisfactory involves the use of expendable aluminium slings, which are looped loosely around the billet. The pole, or boom-attachment, of a lifting truck is threaded through these slings, and the ingot is then lifted and lowered into the furnace, the slings being allowed to melt away.



Strojexport Guillotine Shear

Tocco Induction-annealing Machine for Ball Studs

A special machine for induction-annealing the threaded portions of ball studs for motor cars, as shown in Fig. 2, has recently been supplied by the Ohio Crankshaft Co., 3,800 Harvard Avenue, Cleveland, 5, Ohio, U.S.A., whose agents in this country are the Electric Furnace Co., Ltd., 161 Queens Road, Weybridge, Surrey. Ball studs are fed from a hopper at the rear of the machine into a mechanism which inserts them, one at a time, into pairs of fingers projecting from the edge of a continuously-rotating, inclined-axis table.

In these fingers, the studs are carried past a channel-shaped inductor, as seen in the close-up view, Fig. 1, whereby they are heated to a temperature sufficiently high to reduce their hardness from 60 to 30 Rockwell C. This inductor operates on a frequency of 10,000 cycles per sec. and has a capacity of 50 kW. Prior to the installation of

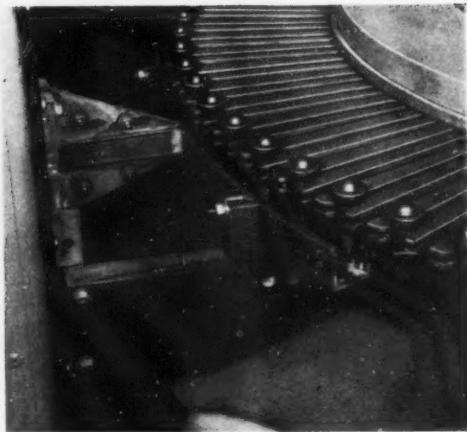


Fig. 1. The Channel-shaped Inductor Used on the Tocco Machine. Ball Studs are Annealed at the Rate of 3,226 per Hour

this machine the ball studs were gas-heated for annealing and could be treated at the rate of 2,128 per hour. This rate has been increased to 3,226 per hour with the new machine, which has reduced direct labour costs by 34 per cent.

On leaving the inductor, the ball studs are carried round to a point at which a curved plough pushes them out of the fingers so that they fall down a chute, out of the machine. In Fig. 2, which was taken while the machine was being prepared for an exhibition, this chute has been temporarily replaced by an inclined conveyor so that the studs are continuously returned to the hopper for recirculation.

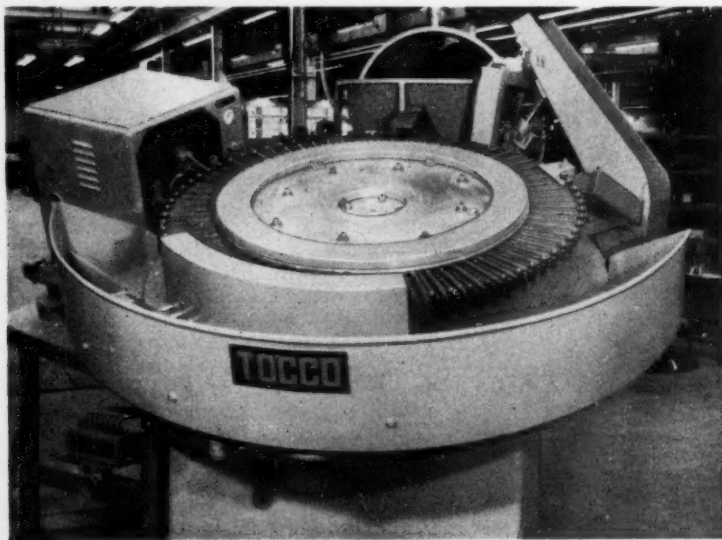


Fig. 2. Ball Studs are Fed Automatically from a Hopper into the Fingers of an Inclined Wheel to be Carried Past an Inductor on this Special Tocco Annealing Machine

Die Casting Supplement

Contract Pressure Die Casting at the Works of Fonderpress, Bologna

One of the best known and largest contract pressure die casting firms in the industrial area of Northern Italy is Fonderpress Di Gamberini Tagliavini & Co., with main offices and tool-making shops at Via M. D'Azeglio, 19, Bologna. Here, all the dies employed in the company's foundry are made, also tools for many other die casting establishments, both in Italy and abroad. The foundry is situated some distance away from the main office, at Via Marco E. Lepido, 19, so that the heat and dirt normally associated with such work cannot affect the precision of die production, and damage to the expensive machine tools from acid fumes in the atmosphere is avoided. Of the two establishments, the foundry is slightly the larger, and it supplies castings to a large number of manufacturing companies in Northern Italy. The average output of the foundry is about 12 to 13 metric tons of castings per day, of which the greater part are in aluminium, only about 5 per cent being of zinc,

partly on account of the difficulties involved in obtaining sufficient supplies of high-purity alloy.

All the die casting machines installed at the Fonderpress foundry are of the water-hydraulic type supplied by A. Triulzi, S.A.S., of Milan (Alexander Cardew, Ltd., 2-5 Studio Place, Kinnerton Street, London, S.W.1), and include units with die closing pressures up to 1,000 tons. A general view of the largest machine in the foundry—Triulzi No. 25M—is given in Fig. 1, where the massive cylinder, whereby the pressure mentioned is applied directly to the platen, is clearly seen. This machine has platens measuring 23½ in. wide and 36½ in. deep between the tie bars and the moving platen has a stroke length of 28 in. Injection forces ranging from 23 to 84 (metric) tons can

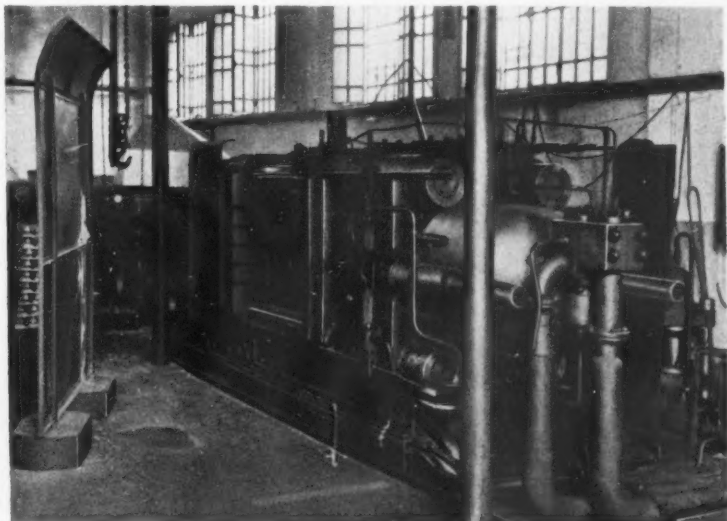


Fig. 1. In this General View Inside the Fonderpress Works is Seen a Triulzi Direct-hydraulic Machine, which is Capable of Exerting a Die-closing Force of 1,000 tons

be applied and the sleeve capacity can be varied from 81 to 406 cu. in. The large cylinder is employed only for closing the dies, and the moving platen is retracted by means of two smaller cylinders, one each side, at about the centre of the platen height. Hydraulic pressure fluid for the operation of moving cores is supplied through telescopic tubes carried in brackets above the platens, and a hydraulic cylinder for the operation of ejector pins is fitted at the centre of the large die-closing cylinder.

Automatic control of the casting cycle is provided, and push-buttons can also be employed for the selection of particular portions of the cycle when dies are being set. An important feature of the controls is the provision for adjusting the final pressure applied by the injection plunger, also the speed of the plunger during its stroke. With this system, the plunger moves forward slowly to fill the cavity, so that air can escape through the vents, and the speed is then increased until a certain pre-set pressure is achieved. The pressure is finally raised automatically to a higher value for the solidification period. A timing unit is also fitted to prevent the dies from being closed too quickly after the removal of a casting where shot weights are large, or, alternatively, to close the dies automatically after a certain time has elapsed so that the tools are maintained at the optimum temperature. The movable screen at the left in Fig. 1 is employed to protect other workers in the shop from flash, should the dies not close properly or open too soon.

Hydraulic pressure for the operation of the die

casting machines is supplied by a battery of Triulzi axial-plunger type pumps installed in a central room, as seen in Fig. 2. Here, three pumps of 9-, 13½-, and 26½-gal. per min. capacity are installed, which deliver the mixture of water with about 5 per cent of soluble oil, to a battery of air-charged accumulators at a pressure of the order of 150 atmospheres (2,130 lb. per sq. in.). From the accumulators, the fluid is supplied to the cylinders of the various machines by way of mains pipes which pass through floor channels. While pressure is maintained in the accumulators, the delivery from the pumps is directed to the tank in the background by a by-pass valve and the pumps operate under low-load conditions. A cooling coil and filters in the system prevent excessive heating of the fluid, and the circulation of dirt which may be picked up.

LAMBRETTA SCOOTER CASTINGS

An interesting development in post-war Italy has been the emergence of the motor scooter as a means of transport, which is very economical, rapid, and allows easy parking even in the centre of a crowded city. Among the best known of these machines is the Lambretta range made by Innocenti, S.p.A., at their Milan factory. As noted in a series of articles published recently in MACHINERY, the Lambretta designs incorporate many aluminium pressure die castings, including several of extremely intricate form, and many of these castings are supplied by the Fonderpress company. For the most part, this article is concerned with some of the

more interesting of these castings and the dies in which they are produced. The latest design of Lambretta scooter, designated the 175 TV, is shown in Fig. 3, and it incorporates a 2-stroke

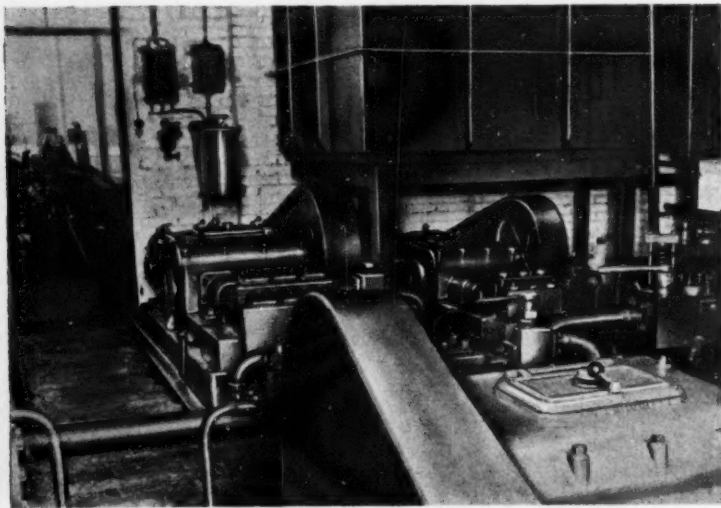


Fig. 2. A Mixture of Water with 5 per cent of Soluble Oil is Pumped into Air-charged Accumulators in this Central Room and Conveyed to the Various Machines Through Mains Pipes in Shop-floor Channels



Fig. 3. In the Range of Lambretta Motor Scooters made by Innocenti S.p.A., of which the Latest 175 TV Design is Here Shown, many Aluminium Pressure Die Castings, Supplied by the Fonderpress Company, are Employed

engine of 170-c.c. capacity which gives it a top speed of approximately 65 m.p.h.

LAMBRETTA CRANKCASE CASTINGS

Typical of the large aluminium alloy parts produced on the Triulzi 1,000-ton machine is the complicated casting of which two views are shown at the top in Fig. 4. This casting forms the crankcase for the motor scooter shown in Fig. 3, and the sequence of operations employed by Innocenti for machining it was described in *MACHINERY*, 92/584—14/3/58, where some details of the casting were also given. In addition to forming the engine crankcase and supporting the cast iron cylinder at one end, the casting houses the 4-speed gearbox and the rear axle, and with the cover seen at the bottom in Fig. 4, forms an extremely neat and well-designed unit. The interior surfaces of the casting, which are formed on projections on the fixed half of the die, are noteworthy for their fine finish, and the evenness of the thin sections of the strengthening ribs will be evident.

The parting plane of the die in which this casting is produced is parallel to the cover face, and the outside surfaces of the part are formed by four interlocking core blocks which are arranged at about 90 deg. to each other on the die face. Slides carrying these cores are operated by means of hydraulic cylinders and one of the cores serves to produce the bore at one end of the casting into

which the cylinder spigot fits on assembly. This core, in conjunction with an adjacent core, also forms the surfaces between the two mounting ears at one end of the casting, and these ears are cored by fixed pins on the die faces, to a diameter of approximately 1½ in. The casting has an overall length of 18½ in. and is approximately 9½ in. high, the width over the largest bosses being 6½ in. A shot sleeve with a diameter of 4½ in. is employed, and the casting, which is made from F480 aluminium alloy, has a trimmed weight of 15½ lb.

The cover casting, at the bottom in Fig. 4, is of approximately the same length and height, the width being just over 3 in. at the widest point. A fairly simple die is employed for the cover, most of the casting surfaces being formed between cavities and projections on the two die faces, and only a few holes are cored. This casting, which weighs approximately 4 lb., is made on a Triulzi 16M machine. Of somewhat similar construction

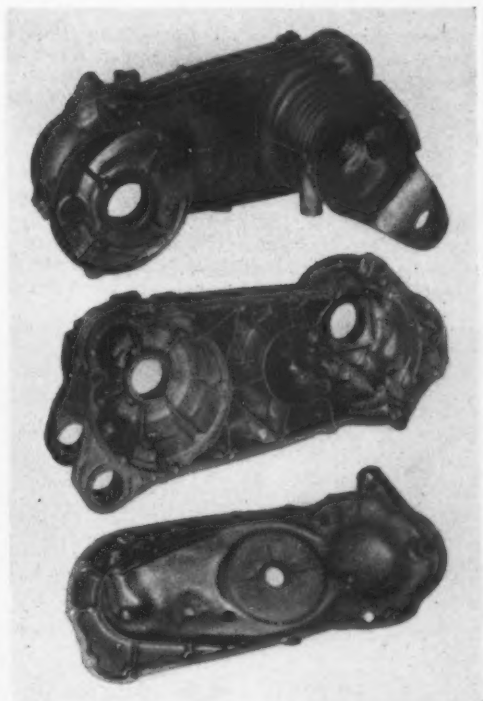


Fig. 4. (Top) Two Views of the Combined Crank- and Transmission Case Casting Employed for the Motor Scooter Shown in Fig. 3, and (below) the Cover Casting for the Unit

to that shown in Fig. 1, this machine has a closing pressure of 750 tons.

DIE FOR LAMBRETТА FRONT CASING

The latest design of Lambretta motor scooter, mentioned above, incorporates a pressure die cast front casing which extends from just above the front mudguard to just below the handle-bars and can be clearly seen in Fig. 3. Made from aluminium alloy, this casting incorporates a shrouded housing for the front head-lamp, also a grille covering the electric horn. Examples of castings in the untrimmed condition, and with the slugs still attached, are seen in the foreground in Fig. 5, together with the die in which they were produced. This die is operated on a Triulzi 16M machine, of 750 tons locking pressure, and the casting has a trimmed weight of nearly 2½ lb. In the die, the cavity is arranged vertically with the sprue at the bottom, the sleeve on the machine being mounted in the lowest of the three positions provided.

For coring the headlamp opening in the casting, a loose piece is employed, two of which are provided, to avoid delays in production. This core is placed, by hand, in the recess in the moving half of the die, and is held and located by means of two stub dowels. Horizontally-moving, cam pin-operated cores, at each side of the die cavity, serve to form the undercut portions surrounding the headlamp opening, and these cores are seen in the retracted position in Fig. 5. A hydraulically-operated core at the base of the die forms the internal surfaces and bosses of the half bell-shaped

portion at the lower end of the casting. At four positions inside the casting, near the two long edges, there are small bosses which are produced by recesses in the moving die half, on the right, and cored by pins housed within the die. One of the spring-loaded plungers for holding such a core in the retracted position, while the die is open, is indicated at A, and the cores are advanced, as the die closes, by mechanisms operated by cam pins of special design.

One of these pins is seen at B, and they are fitted in the face of the fixed die member in line with the direction of die movement. Each pin is cut away for slightly less than half its diameter over about half its length. In the flat surface, thus formed, are machined square-section ribs which are disposed at an angle of 45 deg. to the die face, and these ribs mesh with grooves of similar section on slides connected to the cores. Thus, as the die is closed and opened, the cores are advanced and retracted. This method of operating cores which are housed beneath the die surface and are at right angles to the direction of die movement is fairly widely employed by the company.

LAMBRETТА HANDLE-BAR DIE

The die shown in Fig. 6, with some examples of castings made therein, is employed for the production of handle-bars for the 175 TV Lambretta scooter, mentioned previously. These handle-bars can be seen in Fig. 3, and they incorporate inserts of steel tubing at each end, to which the twist-grip controls for gear changing and throttle operation are fitted. A number of cored holes at different angles provides for the passage of the various cables, and in the centre, at the top of the casting, there is a recess which houses the speedometer, and on the front face, a housing for a lock. When this lock is in operation it prevents the handle-bars from turning so that the machine cannot be ridden away. On the side of the casting which faces towards the rider, there is another housing for an ignition lock to provide additional

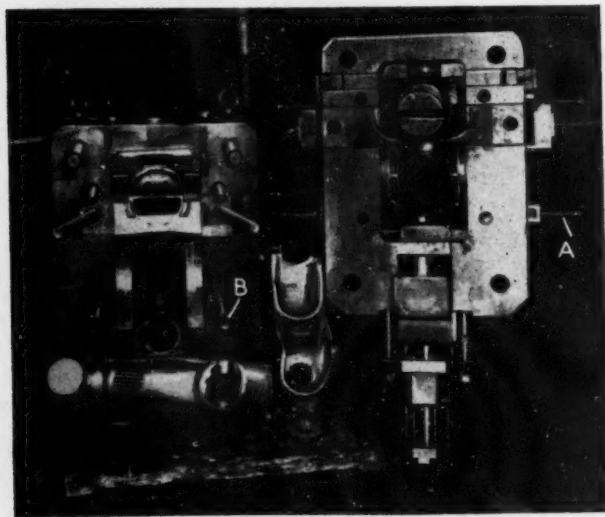


Fig. 5. In this Die, Castings for the Front Casing of the Scooter Shown in Fig. 3 are Produced. A Loose Piece is Employed in the Moving Half of the Die for Coring the Interior of the Shrouded Headlamp Housing

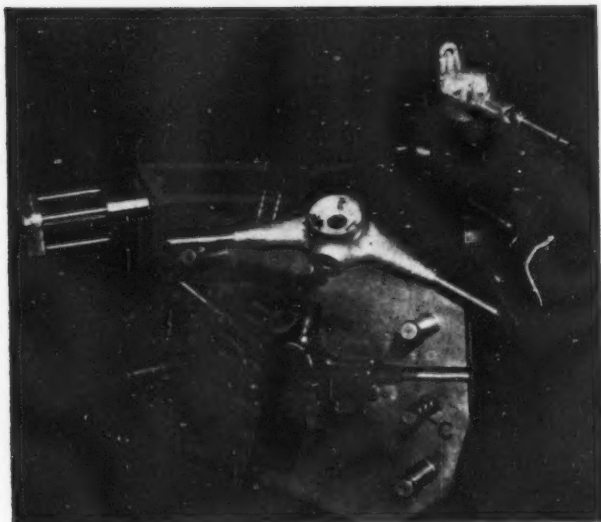


Fig. 6. The Pressure Die Cast Handle-bar for the 175 TV Lambretta Scooter Incorporates Two Steel Tube Inserts for the Twist-grip Throttle and Gear-change Controls and is Made in this Die

security, and these housings are cored by moving slides in the die, all of which are cam operated except one. As may be seen from the position of the sprue hole, the die is mounted in the machine with the handlebar cavity substantially horizontal, and the cores which hollow the lock housings are therefore vertical, one above and one below the cavity.

These cores are cam pin-operated and the upper unit has a coil spring to hold it in the retracted position when the die is opened.

At the nearer side of the moving half of the die, which is in the background in Fig. 6, there is a core set at an angle. This core produces a hole of curved shape in the side of the handle-bar casting, near the

inner end of the steel tube insert, for the passage of the flexible cable to the clutch lever. At the far side of the tool, in a bore beneath the die face, there is another core, which produces a hole of similar shape in an almost symmetrically opposite position at the other end of the handle-bar. This core is operated in the same manner as that mentioned in connection with the front casing shown in Fig. 5, by means of the D-section pin C, Fig. 6, which has a number of square-section ribs on its flat surface. These ribs are again disposed at 45 deg. to the direction of die movement and they engage grooves of similar form on the core slide to advance it automatically as the die is closed. The hole thus produced in the casting serves for the passage of the flexible cable to the lever for the front brake. All the cables on the scooter are enclosed within the frame so that a particularly neat appearance is obtained.

The largest of the moving cores for this casting is set in the centre of the moving die member and

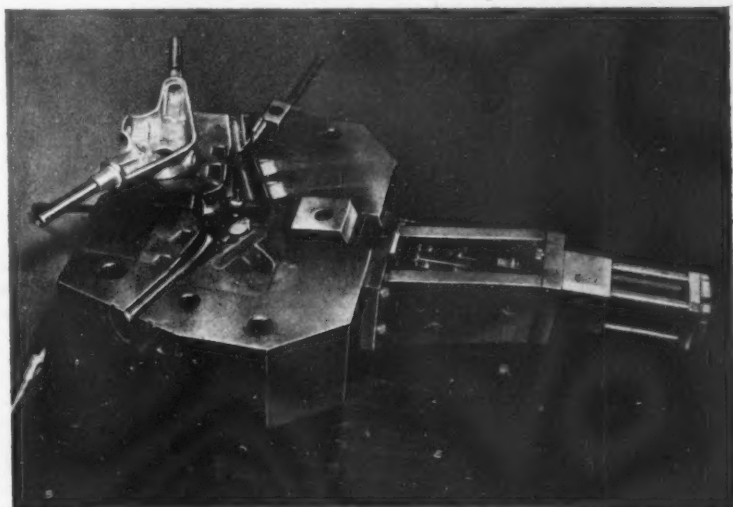


Fig. 7. Another View of the Moving Half of the Handle-bar Die, Showing the End of the Core, at the Cavity Centre, which is Operated by Means of the Hydraulic Cylinder at the Right

is arranged at an angle of 8 deg. to the direction of die movement. This core serves to produce the hollow recess in the centre of the circular boss at the top of the casting, in which the speedometer is housed. Before the ejector pins are operated, the core is withdrawn, through a distance of 20 mm. (0.787 in.), by means of the hydraulic cylinder attached to one long side of the die. Another view of this half of the die is given in Fig. 7, where the end of the core can just be seen at the centre of the cavity. This core is connected to a triangular plate, with a hole near each corner, which is accommodated in a slot in the die wherein it is retained by a pin passing through one of the holes, so that it can function as a bell-crank lever. The third hole in the plate is connected, by another lever and a linkage, to the ram of the cylinder, the arrangement being such that a mechanical advantage is obtained. The slotted yoke, whereby the cylinder ram is attached to the linkage, is provided with rollers at each side, and these rollers move in grooves in the side support members for the cylinder. Consequently, side thrust imparted by the linkage is not transmitted to the ram.

LAMBRETTA TRANSMISSION CASE CASTING

On Lambretta scooters of smaller sizes, with engines of 125 and 150 c.c. capacity, the drive to the rear wheel is taken through a transmission case,

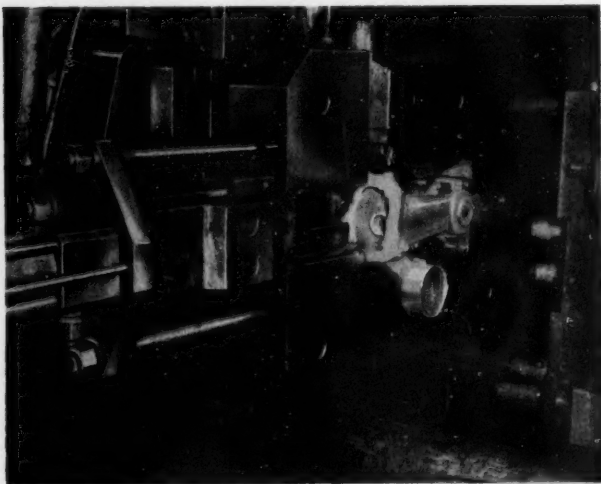


Fig. 8. Shown in Position on the Triulzi 10M Machine, of 350 tons Capacity, this Die is Employed to Produce Transmission Case Castings for the Smaller Sizes of Scooter in the Lambretta Range

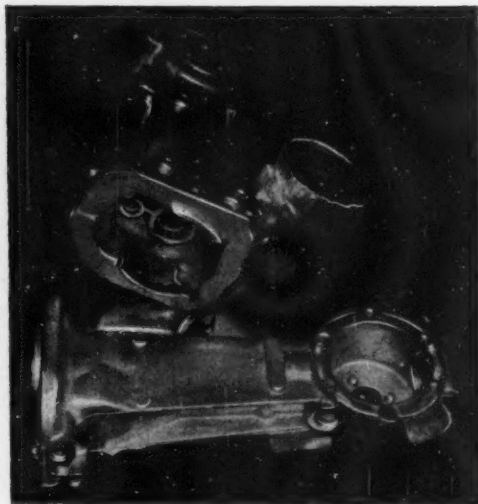


Fig. 9. Two Castings From the Die in Fig. 8. The Excellent Surface Finish and the Virtual Absence of Flash are Noteworthy

which is secured by bolts to the crankcase. The space formed by recesses between the two castings accommodates the gearbox, and the rear wheel, which is mounted at the other end of the transmission case, is driven through a shaft and bevel gears. A die for the production of such a transmission case is seen in position on a Triulzi 10M machine, of 350 tons capacity, in Fig. 8. Here, it may be seen that there is a vertically-moving core slide above the casting cavity, which is operated by cam pins, and provides for forming a deep channel in one side of the casting. Two castings from this die are shown in Fig. 9, where the deep channel is clearly visible in the example in the foreground.

At each end of the die cavity there are hydraulically-operated core slides, and the slide at the far end provides for the bore which communicates with the interior of the circular housing at one end of the casting. This bore continues through into the tapered rectangular portion of the casting, which is cored by the nearer of the two slides. Projections on this slide form circular bosses within the

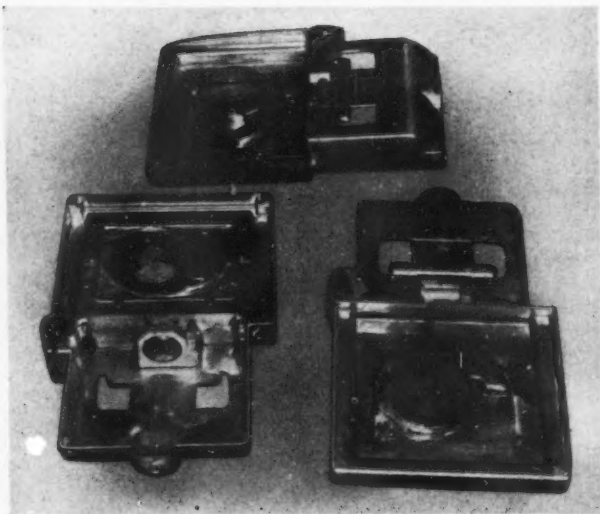


Fig. 10. Three Examples of Photographic Enlarger Base Castings Produced on the Triulzi 1,000-ton Machine

cavity at the larger end of the casting, wherein the gears are accommodated in the final assembly, and the bore through which the main shaft passes. Although hydraulically operated, this last core is also provided with holes for cam pins which serve to apply the extra force required for the initial extraction of the core during the early stages of the die opening movement. Subsequently, the cylinder provides the long withdrawal stroke to carry the end of the core clear of the casting flange. The excellent finish of the castings and the absence of any heavy flash are clearly evident from Fig. 9, where they are shown immediately after removal from the die. The overall length of the casting is slightly more than 14 in. and the large flange measures 6 by 4.8 in. In the trimmed condition, the weight is approximately 5½ lb.

Another casting produced on the Triulzi 1,000-ton capacity machine is for a photographic enlarger base, and three views of this part are seen in Fig. 10. Of aluminium alloy, the casting weighs approximately 6½ lb. in the trimmed condition, and measures about 11½ by 17 by 2 in.

overall. The larger rectangular portion has an opening of similar shape measuring 6½ by 5 in. which surrounds the injection hole in the die and the cavity is gated along two sides of the opening.

Some details of the die employed for this casting may be seen in Fig. 11, which shows the moving half of the tool with a casting supported on the tie bar at the right. There are two horizontally-moving cores, operated in the conventional manner by cam pins, which produce holes of about ½ in. diameter in the sides of the casting. In addition, there is a vertical core, operated by a hydraulic cylinder above the die, which produces other holes, of approximately 1½ in. diameter, in one end wall of the casting, and in the heavy-section boss near the centre, as in the example at the left in Fig. 10.

The die for the enlarger base was not designed for, and does not require, such a large machine. It is only being operated on the 25M die caster for reasons of shop loading and production economy. The ejector pin plate is advanced through a rack and pinion arrangement.

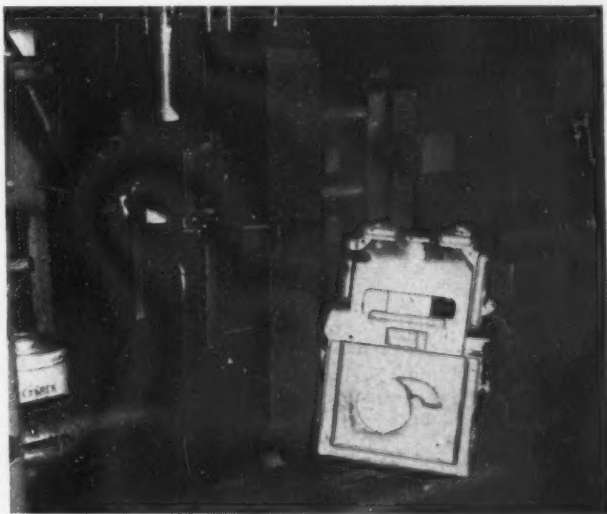


Fig. 11. Close-up View of the Moving Die Member for the Enlarger Base Casting, Mounted on the 1,000-ton Machine

Atlas-Standard Profiling Machine for Railway Wheels

Atlas Engineering Co., Ltd., 48 Princes Gate, London, S.W.7, have acquired the sole rights to build under licence in this country, the patent railway wheel profiling and truing machine developed by the Standard Railway Equipment & Manufacturing Co., Chicago, U.S.A. Construction of British-built machines is being undertaken by North British Locomotive Co., Ltd., Glasgow, exclusively for the Atlas Engineering Co., Ltd., and the first, illustrated in Fig. 1, has recently been completed for the Commonwealth Railways of Australia. British Railways have ordered four machines, and others will be built for railways in Ceylon and Persia.

Weighing approximately 25 tons, the machine is housed in a pit in the shop floor of a maintenance depot for rolling stock, beneath a pair of rails. The entire vehicle on which wheel profiling is to be carried out is moved on the rails, either under its own power or by means of a winch, to bring different pairs of wheels into, and away from, the machining position. This procedure obviates the need for removing and dismantling worn wheel sets, and transferring them to a heavy repair shop for profiling. In consequence, servicing

is greatly facilitated, and the number of wheel sets usually maintained for replacement purposes may be considerably reduced.

The machine can be supplied for handling wheel sets with diameters from 28 to 54 in., and gauge widths from 3 ft. 6 in. to 5 ft. 6 in., for traction units, passenger coaches and goods wagons. A vehicle is moved on the rails from left to right, as viewed in Fig. 1, until the wheels to be machined make contact with freely-rotating rollers, which have been previously moved outwards to their working positions by compressed air. One of these rollers may be seen at A in Fig. 2, which gives a close-up view of the right-hand cutter head. Next, grooved driving rolls, as at B, are moved upwards into contact with the flanges, and cause the wheels to be raised clear of the rails. A portion of rail at each side, is then retracted lengthwise by a hydraulic cylinder so that it is brought clear of the cutting area, as shown, and the wheels are lowered slightly by movement of the driving rolls. The housings shown at C and D, Fig. 1, are now raised hydraulically, and built-in centres are moved horizontally into engagement with the ends of the axle. An endwise load of 8,000 lb. is applied

hydraulically, and the centres are locked by mechanical means. Contact pressure due to the weight of the vehicle is usually sufficient to prevent slip between the wheels and the driving rolls, but hydraulic equipment may be provided, which enables an additional load of 10 tons to be applied downwards through the medium of chains or steel slings passed round the axle boxes.

Driven at a speed of 106 r.p.m. by V-belts from separate 25-h.p. motors, the cutter spindles are mounted at opposite ends of a heavy C-shaped steel casting

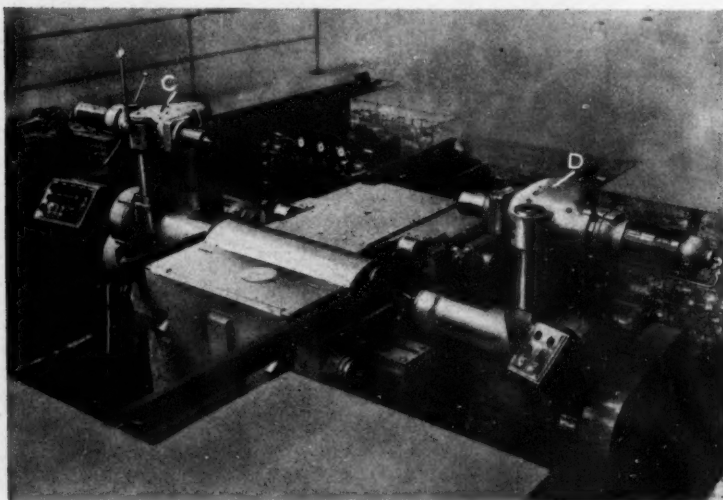


Fig. 1. Atlas Standard Profiling Machine for Railway Wheels

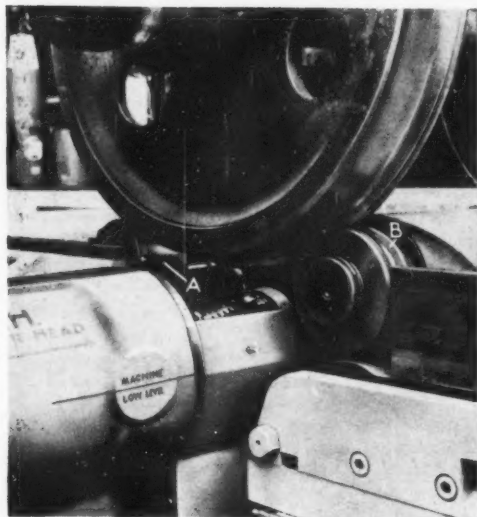


Fig. 2. Close-up View Showing the Right-hand Cutter Head, and the Support and Driving Rolls for the Wheel

which passes under the bed at right-angles to the rails. Profile milling cutters are employed, the design of which will be considered later. When the wheels have been positioned and held by the centres, the cutter spindles are started, and the entire C-frame is then raised, to apply cut, by screws driven by hydraulic motors. Setting for the depth of cut is made with reference to a dial indicator. With the wheels rotating under the action of the rolls *B* (Fig. 2), machining of the entire profile shape on the tread and flange is performed at a single revolution. Drive to the rolls *B* is taken through heavy gearing from a variable speed 2-h.p. motor, and a peripheral wheel speed or feed of 6 in. per min., is usually employed, although speeds or feeds of 4 in., 8 in. and 13 in. per min. can also be obtained, and are used according to the depth of cut and the type of steel to be machined.

Upon completion of

the machining operation, the cutter head is lowered, and the movable portions of the rails are then returned to their original positions in readiness for supporting the wheels when the centres and the rolls *A* and *B* have been moved clear. Setting up and applying the cut for a pair of wheels occupies a period of only 7 to 8 min., and it is stated that the entire profiling cycle can be performed on a 4-wheel unit in 1 to 1½ hours. When the machine is in the fully lowered position, the track can be used as a run-through line, if necessary.

The machine can be operated by one man, and the various motions are controlled by switches conveniently grouped on panels at both sides of the operating platform.

Cuttings fall on to a chute and are thence passed through a pipe by compressed air to be discharged into a container mounted on the shop floor. The pump for the hydraulic system is driven by a 15-h.p. motor.

CUTTER DESIGN

Made exclusively for Atlas Eng. Co. by Firth Brown Tools, Ltd., Sheffield, the cutters have a maximum diameter of 7½ in., and are supported at their outer ends by suitably protected ball races. A pair of cutters is shown in Fig. 3. Each incorporates a total of 110 cylindrical inserts of Atlas Mitia carbide mounted in ten holders of a rectangular cross section, which are set at an angle to the axis and secured in slots at the centre and ends of the body by screws. The inserts are accurately located by partly-circular holes, which are precision bored at an angle near the edges of the holders to provide clearance.

The disposition of the holes is such that the sets of inserts are staggered by a small amount in relation to each other. In consequence, when the

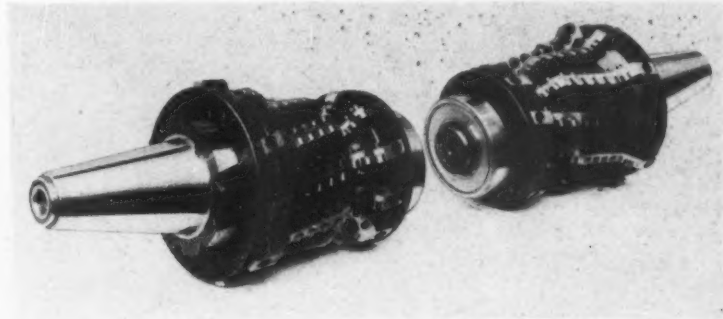


Fig. 3. A Pair of Profile Cutters for the Machine Shown in Fig. 1

cutter and a railway wheel are rotated in mutual engagement during the machining operation, a continuous cut is taken over the entire width of the profile shape on the tread and flange, and it is stated that a very smooth surface finish is obtained. Cuts with maximum depths of 0.3 to 0.35, 0.15 to 0.25 and 0.125 to 0.175 in. may be taken on the flange, flange throat, and tread of steel tyres, which have tensile strengths not exceeding 45 tons per sq. in., and proportionately smaller cuts for steels of higher strengths.

When the inserts have become dulled over part of the periphery, they may be turned, upon

release of central clamping screws and nuts, so that fresh cutting edges are presented to the work. A total of 16 cutting positions can be obtained in this way, and when the entire periphery at one end has become dulled, the inserts may be reversed. From 12 to 16 cuts can usually be taken before indexing of the inserts becomes necessary, when steel tyres with a tensile strength of 42 tons per sq. in. are being machined. Assuming that the average number of cuts taken per indexing is 14 and that profiling of each tyre is performed at one rev., 448 wheel sets can be machined before the inserts need to be replaced.

New Hollow Pressure Die Casting Process

Demonstrations were recently given, in London, of a prototype machine developed by Robar Products (London), Ltd., 39 Park Street, London, W.1, for the production of hollow pressure die castings for which no internal cores are required. The new process is analagous to the conventional slush-casting method except that the metal is forced into the cavity under pressure and the excess is withdrawn under a partial vacuum. If necessary, to improve the quality of the casting surfaces, for instance, the die cavity can also be evacuated immediately before the metal is injected. After a sufficient thickness of the molten metal

in contact with the cavity walls has solidified, the still liquid metal in the casting interior is withdrawn by retraction of the injection plunger. Since the metal in the die cavity now forms a continuous shell, the withdrawal of the plunger produces a partial vacuum in the casting.

A general view of the prototype machine is given in Fig. 1, from which it may be seen that it is of conventional construction and incorporates an air cylinder for operating the toggle mechanism which actuates the moving platen. Two tier bars are disposed on the longitudinal centre line of the platens and the dies are fitted between them. Designed for development work with zinc alloys, the machine is of the hot-chamber type, but the arrangement of the injection mechanism is somewhat unusual. The sleeve is disposed at an angle of about 15 deg. to the vertical, between the fixed die member and the pot, and the air-operated injection cylinder is arranged in line with the injection plunger in the sleeve. From an opening near the base of the pot, the metal can flow downwards to fill the sleeve through a valve controlled by the air cylinder A. This valve is closed immediately before the injection plunger is operated.

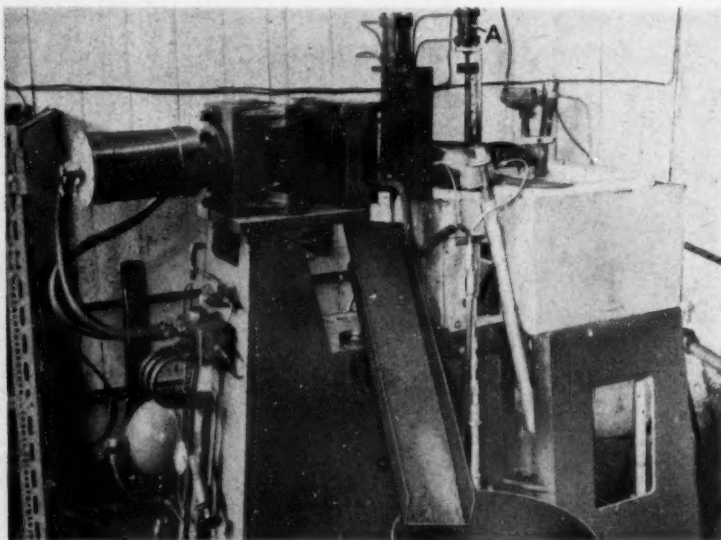


Fig. 1. Prototype Machine built by Robar Products (London), Ltd., for the Evaluation of the New Hollow Pressure Die Casting Process for Producing Hollow Castings Without the Use of Cores

As mentioned above, provision is also made for the application of a vacuum to the die cavity after the dies have closed and immediately before the metal is injected. Another air-operated valve, on the die, is then closed at the same time that the metal is injected, to prevent it from passing into the vacuum line. The various machine movements and the operation of the air cylinders are controlled from a centralized cabinet, which is seen, with its covers removed, in Fig. 2. In the base of this cabinet there is a motor-driven vacuum pump which is connected to a vacuum chamber at the rear. Pilot valves are connected to the main control valves for the die-closing and injection plunger-operating cylinders on the machine, and the sequence of operations is determined by means of small air cylinders, the rams of which operate the pilot valves at both ends of their strokes.

Restrictor valves are connected in the lines leading to these cylinders so that the speeds at which the rams travel may be steplessly adjusted. For instance, one of these cylinders is actuated at the same time as the injection plunger cylinder, and at the end of its travel the ram operates a pilot valve, to reverse the direction of the air supply to the injection cylinder. The period allowed for solidification to form the required wall thickness can thus be very accurately adjusted. This adjustment is made largely by trial and error, with a new die, and once the required setting has been determined, it can be easily repeated, if records are kept. The die halves are water-cooled and are normally operated at a surface temperature of about 200 deg. F., only a short solidification time being needed for the thin walls of most castings for which the process is suitable.

CYCLE OF OPERATIONS

No electrical circuits are employed, the entire sequence being controlled by the air valve and cylinders mentioned, and the machine may be set for automatic cycle or may be hand operated for setting purposes. With the automatic cycle setting, there is normally an operator, who ensures that the ejected casting falls clear of the die faces before he presses a button, on a pilot valve beneath the die closing cylinder in Fig. 1, to initiate the next cycle, but the machine could, of course, be arranged to operate fully automatically. The die closes in the normal manner, and if any moving cores are employed to produce holes or other accurate cavities in the casting, they are next moved into position by means of air cylinders, such as that seen above the die in Fig. 1. If the die is to be evacuated, the valve to the vacuum chamber is next opened, and it is closed again

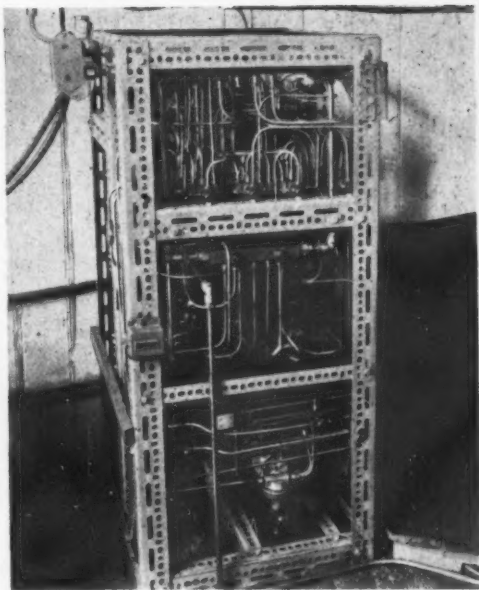


Fig. 2. The Sequence of the Machine in Fig. 1 is Controlled by Air-operated Pilot Valves and Cylinders Housed in this Cabinet. A Motor-driven Vacuum Pump is also Incorporated

immediately before the metal in the shot sleeve enters the die.

After the pre-set period for solidification of the shell of metal in contact with the cavity walls has elapsed, the injection plunger is withdrawn. The valve controlled by the cylinder A, Fig. 1, is then opened, and more metal is thus allowed to flow from the pot to fill the sleeve, the moving die is retracted, and the casting is ejected in the normal manner. A period of 3 to 10 sec. is required for this cycle, the solidification period varying from a fraction of a sec. up to 1 or 2 sec. according to the thickness of the casting walls required. Owing to the shortness of this period, the metal forming the cavity surfaces is not heated so much, or subjected to the corrosive action of molten zinc, or other alloy, to the same degree as with the conventional process. Steels of lower alloy content, or of compositions more suitable for die-sinking by the cold-hobbing process may therefore be employed. Other materials may also be used for dies, including brass and copper alloys which may be cast to the required form.

Where steel is employed for a die, the surfaces may be hardened to ensure long life, the operating

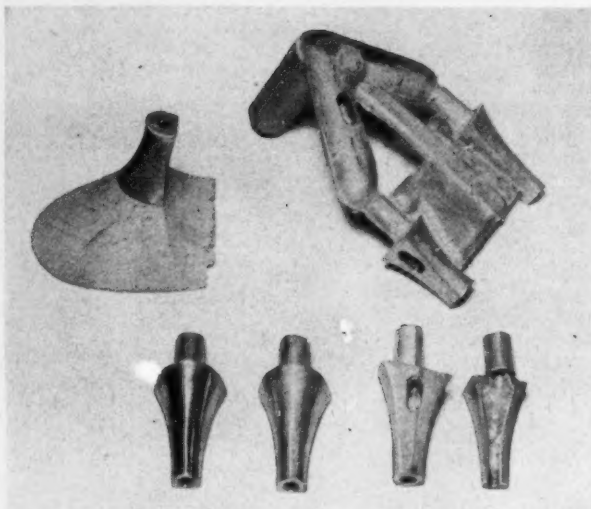


Fig. 3. One Application of the New Hollow Die Casting Process is for the Production of Hollow Zinc Alloy Heel Tips for Shoes. Large Savings of Material are Obtained Without Sacrifice of Strength

temperature being insufficient to cause tempering. Low operating temperatures also enable castings to be produced with very little flash, since the distortion of the die is kept to a minimum. Another important advantage is that the surface of the casting is comparable with that of a part produced by the conventional pressure process. The low surface temperatures ensure dense surfaces, and where the article is to be plated, the application of a vacuum to the cavity will result in a casting with little porosity, which can be easily and quickly polished.

Some examples of castings from the die seen in position on the machine in Fig. 1, which is operated without a vacuum, are shown in Fig. 3, together with a spray of castings in which slots have been machined to show the hollow interiors. These castings are for the heel tips of women's shoes,

an example of which is seen at the upper left, and since they are normally covered with leather or plastics a rough surface is preferred to ensure better adhesion. The casting at the left of the lower row has been buffed lightly, after being broken from the spray, to indicate the ease with which a polished surface can be obtained. Next to it is a casting in the condition in which it leaves the die, and to the right, another example with a slot milled in one side to show the interior. At the extreme right is a sectioned casting from which the wall thickness may be noted.

It will be observed that each casting is cored at the end which comes into contact with the ground when the shoe is worn, and the hole produced is tapped for the reception of a screw to hold a protective tip in position. The cores for the holes in the two castings, which are of different sizes, are operated by means of the air cylinder above the die in Fig. 1. It may be noted that the die in which these castings were made

has already been operated for 170,000 shots and shows little sign of deterioration.

Other examples of castings for which the process is suitable include gas bottles and bodies for butane gas cigarette lighters, as shown in Fig. 4. The bottles are normally produced with wall thicknesses of the order of 0.050 in. and have been tested at pressures up to 3,000 lb. per sq. in.,

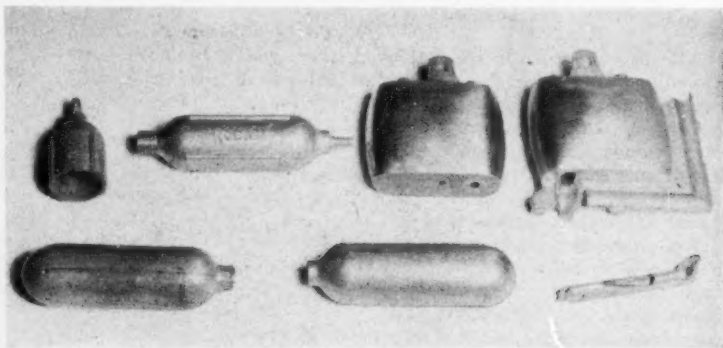


Fig. 4. Further Examples of Coreless Hollow Pressure Die Castings Include these Butane Gas Cigarette Lighter Bottles and Lighter Bodies. Improved Surfaces for Plating are Obtained by the Application of a Vacuum to the Body Die Before the Metal is Injected

which is greater than they would be required to withstand in service. A threaded insert is incorporated in each bottle and at the other end there is a boss which is threaded at a subsequent machining operation.

It is stated that the hollow die casting process can be employed for the production of such components with solid bosses, or bosses with increased wall thickness.

To enable this thickening to be obtained, provision is made for a pause during the withdrawal stroke of the injection plunger, to allow additional metal to solidify in the required positions, the bosses being formed at the lower side of the die cavity. Variations in the wall thickness of a casting could also be obtained in this manner.

The two body castings for butane gas lighters, seen in Fig. 4, were produced in a die to which a vacuum was applied with the object of improving the casting surfaces for plating. This die has provision for the incorporation of a brass insert in the

base, and for the formation of cored mounting ears and bosses on the top surface. An indication of the efficiency of evacuation of the casting by the withdrawal of the injection plunger is afforded by the piece of runner bar seen lying in the foreground at the lower right. This runner bar, for a lighter body casting, has been broken away at two places to show the evenness of the wall thickness. Normally a lower limit of 0.045 in. for wall thickness is imposed for reasons of strength, but it is possible to cast much thinner sections. While experiments were in progress, some castings were produced with walls so thin that they collapsed in the die under atmospheric pressure when the injection plunger was withdrawn.

In addition to the castings illustrated, it is suggested that the process could be effectively employed, for example, for the production of door handles for motor cars, and would permit substantial savings of material while providing adequate strength.

Trade Publications

HYMATIC ENGINEERING CO., LTD., Redditch, Worcester-shire. Illustrated leaflet (publication No. HEC.650) giving details of the design and development of the company's hydraulic and pneumatic test rigs for such equipment as compressors, valves, pumps (both vacuum and hydraulic), and flexible hoses.

BEACON MACHINE TOOLS, LTD., Hurst Lane, Tipton, Staffs. Leaflets describing the "Superior" type V, V2, and V3 motor driven surface grinders. The V3 machine has a table travel of 15 in., and the V and V2, of 14 in. For each, the cross traverse is 7 in.

WESTINGHOUSE BRAKE & SIGNAL CO., LTD., Automotive and Industrial Products Division, Hanham Road, Kingswood, Bristol. Informative publication concerned with the company's range of pneumatic equipment. Separate sections are devoted to control, positioning, and auxiliary devices, compressors, supply fittings, and typical installations.

THE MORGAN CRUCIBLE CO., LTD., Battersea Church Road, London, S.W.11. Folder concerned with the company's Crusilite non-metallic elements for electric furnaces. These elements, which can be employed for temperatures up to 1,500 deg. C, are made in various types and sizes, and information is included on design, characteristics, and methods of mounting.

THE RUCOCO HACKSAW MACHINE COMPANY, Albion Way, Exhibition Grounds, Wembley, Middlesex. Illustrated leaflet describing the hacksawing machines made by Maschinenfabrik Walter Cordier, K.G., W. Germany, which are available with 2 or 4 cutting speeds, alternatively with a steplessly variable drive. Machines are built in

five sizes, with capacities for cutting 6, 8, 10, 12 or 16 in. round or square bars.

EXPANDITE, LTD., Chase Road, London, N.W.10.— Leaflet describing the company's Metagalv anti-rust compound. This preparation is applied cold, by brush, and has a zinc content of 92 to 95 per cent, by weight. The coating is said to have corrosion-resisting qualities comparable with those obtained by hot-dip galvanizing, and is adherent to existing rust, which it converts into black oxide of iron. Applications include railway rolling stock, iron sheeting, and factory girders.

DAWE INSTRUMENTS, LTD., 99/101 Uxbridge Road, Ealing, London, W.5. Leaflet describing the type 1412 impact noise analyser, which is a portable battery-operated instrument for measuring the peak amplitudes and analysing the characteristics of repetitive and other impact noises, in conjunction with the type 1400 sound level meter. Another leaflet is concerned with the type 612 sensitive electronic voltmeter for the measurement of true r.m.s. values of complex voltage wave-forms.

PRATT & WHITNEY CO., INC., Charter Oak Boulevard, West Hartford, 1, Conn., U.S.A. Folder giving particulars of a recently-introduced range of "throw-away" carbide tips. Of square and triangular forms, these tips can be supplied in utility and precision grades, and for negative and positive rake cutting. Other new publications are concerned with the Magnespark vertical profiling machine and the company's extensive range of precision, rotary tables of horizontal, vertical and tilting types. This range includes hand-operated, motor-driven, optical, automatic indexing and numerically controlled tables Buck & Hickman, Ltd., Otterspool Way, By-Pass, Watford, Herts, represent the Pratt & Whitney Co. in this country.

News of the Industry

Leicester

A. A. JONES & SHIPMAN, LTD., Braunstone, are well employed with the construction of various types and sizes of plain, universal and production cylindrical grinding machines, some of which are being provided with Taylor-Hobson automatic sizing equipment. Hydraulic surface grinding machines, of 6- by 18- and 10- by 27-in. capacity, and tool and cutter grinding machines are other active lines. A fair proportion of the current output is destined for Commonwealth and Continental countries. The range of Micromatic honing machines produced is being extended to include the No. 150 hand or automatic horizontal type, with 12-in. stroke, for 1½-in. bores, on which the head and not the table is traversed. Tooling equipment and fixtures for the honing machines are now being made at these works. We understand that some capacity is again available for the building of automatic drilling machines.

In the small tools department, extensions are being made, and the latest additions to the manufacturing programme include a double-swivel precision machine vice, milling machine arbors, carbide-tipped lathe centres, and self-lubricating centres. The sole agency for the Impero range of interchangeable boring and turning tools for lathes has recently been acquired. Cylindrical and surface grinding machines of the latest types are to be exhibited at the Paris and Milan Fairs in September.

S. RUSSELL & SONS, LTD., are steadily engaged on the production of Hydrofeed sawing machines, equipped with saws from 12½ to 38 in. diameter, and including a number of automatic bar machines. Orders also cover swivel-base machines for constructional works, vertical-type sawing machines, and automatic saw sharpeners. Our attention was drawn to a recently-developed, air-operated, high-speed non-ferrous sawing machine, for rounds up to 5 in. diameter, to which we hope to make further reference in due course. On export account we may note orders for India and Australia. Activity is well maintained in the general engineering and steel fabrication departments at these works, and the foundries are experiencing a good demand for spheroidal-graphite and alloy iron castings, but there is less activity in the grey-iron section. A Tagliaferri mains-frequency, 700-kVA., 6,600-volt,

3-ton capacity furnace has recently been installed in the foundry to augment the output of S.G. iron.

FREDK. POLLARD & CO., LTD., have home and overseas orders in hand for their standard ranges of single- and multi-spindle, bench and column-type, vertical drilling machines, 21- and 28-in. heavy-duty upright drilling machines, and radial drilling machines. There is a brisk demand for a variety of special drilling and boring equipment, which includes both horizontal and vertical production-type machines provided with tooling equipment and fixtures for large-quantity operation, as required particularly by the motor-car industry. Extensions to the fitting shop at these works are now nearing completion.

WADKIN, LTD., are occupied on a considerable range and variety of woodworking machinery for customers both at home and abroad. In the non-ferrous metal working machinery section of the works we noted heavy-duty radial arm routers, high-speed routing machines, high-speed vertical milling machines, and cutting-off saws of various types. Our attention was drawn to the latest universal pattern milling machine with power-operated table, the latter having steplessly-variable traversing speeds on the bed from 3 to 90 in. per min. The table unit can be power-rotated at ¼ to 4 r.p.m. In addition, the top table, which measures 36 in. square, can be rotated by hand or power. We hope to make further reference to this machine at a later date. In the woodworking machinery section, we noted a special, transfer-type, double duplex cutting-off sawing machine, with conveyor and raising and lowering mechanism, for cutting accurately square plywood and wall board panels up to 8 by 4 ft. A new pattern shop has been built at these works, and the old shop is now equipped for apprentice training. Extensions in progress to the canteen include the provision of a new kitchen and staff dining rooms.

ADCOCK & SHIPLEY, LTD., have a big programme of work in hand, which includes plain and universal, horizontal and vertical milling machines, over the full range of sizes, unit-head machines, and standard radial drilling machines. The No. 1 horizontal milling machine equipped with air-hydraulic automatic cycle feed mechanism is now in production. Among the special machines on order we may note a large batch of universal

machine tools for the Admiralty, and deep-hole drilling machines and piston drilling machines are in hand for the motor-car industry. Export orders have recently been received from Australia and Canada. This firm is showing a No. 0 air-operated, hydraulically-controlled, automatic cycle, horizontal milling machine on the Engineering Centre Group Stand, in the British Industries Pavilion, at the Brussels World Exhibition, which will continue until October 19. The latest addition to plant at these works is a Jones-Shipman slot-Hydromil.

TAYLOR, TAYLOR & HOBSON, LTD. (A Member of Rank Precision Industries, Ltd.), are experiencing a steadily-maintained demand for their various products, including Talysurf surface roughness measuring instruments, Talyrond roundness measuring equipment, engraving machines, pantograph milling and die-sinking machines, Javelin etchers, cutter grinding machines, micro-alignment telescopes, projectors, auto-collimators and Talymin gauges. Recently-introduced equipment, to which our attention was drawn, comprises the type 100 portable Talysurf surface measuring instrument, J-R routing machine, Mullard ultrasonic engraving tool, and automatic sizing equipment for use on cylindrical grinding machines. At a later date we hope to make further reference to these new items.

H. B.

New Premises for Joseph Pugsley

Extensive new premises at the junction of Church Road and Russell Town Avenue, Bristol, were completed recently for Joseph Pugsley & Sons, Ltd., Lawrence Hill, Bristol, 5. The new building, shown in the accompanying illustration, provides a

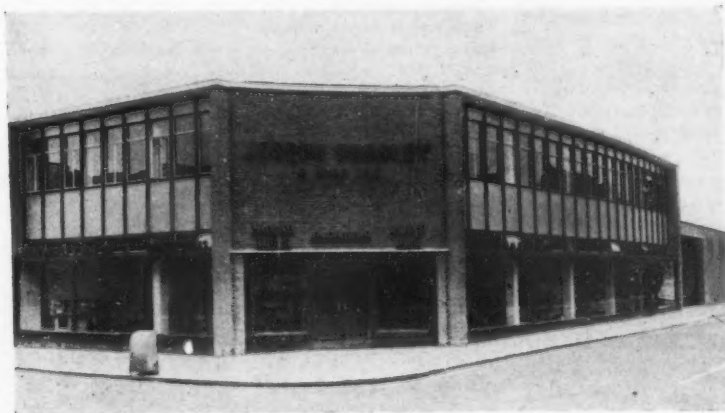
large showroom for machine tools and other equipment on the ground floor, and at the rear there are stores where stocks of engineers' small tools are maintained for immediate delivery. Above the showroom there are modern offices.

Established for more than 80 years, the company provide services for the engineering industries in the West of England and other parts of the British Isles. Apart from the supply of new and rebuilt machine tools, a large contractors' plant hire depot, with an extensive range of machines, is maintained at Stoke Gifford, near Bristol.

Film on Wheel Manufacture

A short film which compares the past and present methods of producing assembled wheel disc and rim components at the Coventry factory of the Dunlop Rim & Wheel Co., Ltd., has been made by the Dunlop Technical Film Unit. The first part of the film shows, in detail, the procedure and machines which were originally employed for pressing the wheel-disc and rolling the rim, whereby 320 of the former and 120 of the latter were produced per hour. A total of 19 machines and 21 operators were required with this method, and apart from the fact that the production rates were unsatisfactory, a large amount of manual work-handling was involved. Also, the procedures were considered, in some instances, to involve undue risk of accidents to hands and feet.

In the second part of the film, the present production methods are very clearly described, with particular emphasis on the transfer feeding mechanisms by which the wheel discs are carried through the presses. The production of the discs and details of this transfer mechanism were described in *MACHINERY*, 88/461—13/4/56. For producing the rims, the new set-up provides for 13 separate operations, seven of which are fully-automatic. Man-handling of the coiled stock for these parts, which represented the greatest source of danger in the original process, has been completely eliminated, and the welding operation for joining the strip into a circle is carried out in a fume extraction cabinet.



New Showroom and Office Premises of Joseph Pugsley & Sons, Ltd.

A total of seven operators and two inspectors are required to control the complete process, excluding the assembling and riveting of the two parts into a complete wheel, and the production rates for discs and rims are now 720 and 500 per hour, respectively. Copies of this film, which runs for 14 min., are obtainable, on free loan, from the Dunlop Film Library, 269 Kingston Road, Merton Park, London, S.W.19.

Cleanliness in Manufacture

(Continued from page 231)

assessing and comparing the results obtained. One method that has been employed for this purpose involves the application of a test contaminant containing a radio-active isotope. The number of counts per minute per unit area before and after cleaning then affords an indication of the effectiveness of the treatment.

Assembly of meticulously cleaned parts must obviously be carried out under conditions which will minimize the risk of subsequent contamination. In this connection, precautions must, of course, be taken to prevent damage due to perspiration from the operators' hands, and special cabinets are now available which enable units to be built up in a local purified atmosphere. For the most exacting work such cabinets should be installed in "clean" rooms which are likely, in the future, to become an increasingly common feature of factories engaged in certain classes of production. Requirements for such a "clean" room were admirably described by Mr. H. G. Harris, M.A., during the course of a paper read recently before the Institution of Mechanical Engineers. He stressed, for example, the need for easy cleaning within the room, the importance of windows and the desirability of excluding electrical equipment.

In conclusion, it should be pointed out that where final cleanness of an assembly is particularly important, regardless of other precautions that may be taken, individual parts should be so designed that dirt particles are readily removed. It is also necessary to ensure that fragments of metal are not detached during the final assembly stage, and for this reason, force fits, for example, and the use of locking washers, or screws with slotted heads, should be avoided.

Trade Enquiries

[Replies should be addressed to the Enquiry Department, Clifton House, 83-117, Euston Road, London, N.W.1 (Euston 8441).]

(No. 0628) Goodchap patented lathe tool post. Maker's or agent's name wanted.

Canadian Machine Tool Census

A census of the machine tools, metal-forming equipment, welding machines, materials handling units, and special machines, at present in use in Canada, has recently been compiled by the research department of the Maclean-Hunter Publishing Co., Toronto, and was published in the July issue of *Canadian Machinery and Manufacturing News*. Among other information, the survey revealed the age, location, and type of 262,000 major items of production equipment, and it is interesting to note that an analysis from the standpoint of the age of metal working machinery in current use discloses that almost 17 per cent is more than 20 years old, and nearly 50 per cent is more than 10 years old. These percentage figures, it is stated, correspond very closely with those obtained from similar investigations in the U.S.A.

Personal

MR. BRIAN SKELTON has been appointed manager of the Cambridge depot of Kerry's (Great Britain), Ltd., Warton Road, Stratford, E.15. He was formerly at the Stratford, Ipswich, and Middlesbrough depots.

MAJOR GENERAL L. E. CUTFORTH, K.B.E., C.B. (Retd.), has been appointed Director General of Inspection, Ministry of Supply, in succession to Sir Thomas Barnard, C.B., C.B.E., who is retiring from the public service.

MR. JOHN BEECH, who graduated at Sheffield University this year with first class honours in metallurgy and won the Mappin Medal and Premium, is to join the metallurgical research staff of the British Steel Castings Research Association in August.

MR. CHARLES H. MORRIS has been appointed managing director of Wadkin, Ltd., Leicester, in succession to the late Mr. L. Austin. Mr. Morris joined the company in 1919 and has been sales director since 1936.

MR. S. RADCLIFFE, B.Sc.(Tech.), A.M.I.Mech.E., M.I.Prod.E., and Mr. W. L. SIMS, O.B.E., M.I.E.E. M.I.Mech.E., have been appointed assistant managing directors. Both have been members of the board since 1942, and as technical directors have been largely responsible for the design and development of the company's current range of woodworking machines and machine tools for non-ferrous metals.

MR. J. H. DEVONALD, A.M.I.Prod.E., who is works manager at Leicester, has been elected a director.

With the transfer of production from the Halifax works of J. Sagar & Co., Ltd., to Leicester, Mr. JOHN SAGAR has resigned his appointment as managing director of that company and from the board of Wadkin, Ltd.



Mr. C. H. Morris

Industrial Notes

KELVIN & HUGHES (INDUSTRIAL), LTD., inform us that, as from August 11, their administrative offices will be housed in a new building at Empire Way, Wembley, Middlesex (telephone number, Wembley 8888).

CITY AND GUILDS OF LONDON INSTITUTE, Gresham College, Basinghall Street, London, E.C.2, inform us that they have revised the courses for the following subjects: patternmaking; foundry practice; boilermakers' work; sheet metal work; welding; and fabrication of steelwork. Full details of the new schemes are available from the Director of the Institute, at the above address, and enquiries should be marked "B.5."

FIRTH CLEVELAND INSTRUMENTS, LTD., Treforest Industrial Estate, Glamorgan, a member company of the Firth Cleveland Group and a subsidiary of Simmonds Aerocessories, Ltd., inform us that they have concluded an agreement with the Gilbert & Barker Manufacturing Co., West Springfield, Mass., U.S.A., which covers the manufacture and marketing in this country of the Gilbarco electronic tank contents gauge.

BOROUGH POLYTECHNIC, Borough Road, London, S.E.1, has arranged a course of eight evening lectures, starting on October 8, entitled "Modern Developments in Metal Finishing." The lectures will provide a detailed survey of some selected methods of metal-finishing, and reference will also be made to human relations in the plating industry, and to costing. Further details of this course may be obtained on application to the Principal at the above address.

THE ROYAL SOCIETY FOR THE PREVENTION OF ACCIDENTS, 75, Victoria Street, London, S.W.1, have adopted the theme "Extra Care Stops Falls" for the next National Industrial Safety Week, which will be held from September 29 to October 4. The campaign will be directed to reducing the total number of industrial accidents, with particular emphasis on those associated with falls, and will be supported by accident prevention groups throughout the country, and various Chambers of Commerce. To assist managements in organizing their own campaigns, the Society has prepared a range of publications in the form of leaflets, folders, posters, and booklets.

AN INTERNATIONAL CONFERENCE ON INFORMATION PROCESSING will be held in Paris from June 15 to 20, 1959. This conference is being organized by the United Nations Educational, Scientific, and Cultural Organization (UNESCO), and among the items to be discussed may be noted: methods of digital computing; design of digital computers; and the automatic translation of languages. Enquiries about this conference, and offers of papers (accompanied by abstracts) should be addressed to the Hon. Secretary, Group B—Computation and Automatic Control, British Conference on Automation and Computation, c/o The Institution of Electrical Engineers, Savoy Place, London, W.C.2.

THE MORTIMER ENGINEERING CO. and STANHOPE MACHINE TOOLS, LTD., announce that an agreement has been reached between them whereby, as from August 1, they will co-operate in the sale and servicing of the ranges

of machine tools and machine shop equipment for which they are representatives throughout the United Kingdom. Under this agreement the companies will continue to operate separately, but it is envisaged that many of the existing facilities will be pooled for the purpose of providing improved service to customers.

To facilitate such co-operation, Stanhope Machine Tools, Ltd., have occupied new offices and showrooms at 202 Acton Lane, Harlesden, London, N.W.10, adjacent to the premises of the Mortimer Engineering Co. at 204-206 Acton Lane.

Obituary

MR. JOHN PICKTHALL, of the Compoflex Group of Companies, was killed in a motor car accident, on July 17, at the age of 48. He joined The Compoflex Co., Ltd., after the war as a representative, and later became Northern Area manager, and subsequently home sales manager. When the Compoflex Group was formed in 1957 he was appointed group sales manager.

MR. E. H. PINK, production manager of the Cinetra Mfg. Co., Ltd., Oval Road, N.W.1, has died, at the age of 59, after a short illness. He had been in the employ of the same family since he started as a boy of 14 under Mr. Leo Kamm of Kamm & Co., Islington. When Mr. Leonard Kamm started the Cinetra Mfg. Co. in 1932, Mr. Pink joined the firm as foreman, and subsequently held the post of general foreman and, later, of production manager.

The Price of a Subscription to MACHINERY is 52 Shillings per annum, post free, to any part of the world.

Subscribers are not bound for any definite period of subscription. We send MACHINERY, post free, each week until told to stop. Subscribers can pay yearly, half-yearly, or quarterly, pro rata. (Cash with order)

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30/7/58

Machine Tool Share Market

Middle East uncertainties continued to make their influence felt in stock markets during the period under review and very sensitive conditions prevailed. After some sharp setbacks, however, a rallying tendency developed, and most sections finished on a fairly firm note.

The gilt-edged market showed weakness at the outset, but absence of selling pressure had a steadying effect, and a mild revival of buying activity towards the close led to a general improvement in prices.

Commercial and industrial share markets were unsettled, but after displaying an easier trend for the most part, they became moderately active, and closing prices were above the lowest.

Among machine tool issues Edgar Allen advanced 1s. to 30s. 6d.; Brooke Tool, 6d. to 4s. 9d.; British Oxygen, 2s. to 36s. 6d.; Butler Machine Tool, 3d. to 6s. 3d.; Alfred Herbert, 1s. 3d. to 35s.; and Kitchen & Wade, 9d. to 11s. 6d. On the other hand, Birmingham Small Arms lost 6d. at 27s. 6d.; Wadkin, Ltd., 6d. at 17s. 6d.; Churchill Machine Tool, 3d. at 17s. 7½d.; Geo. Cohen, 3d. at 10s. 9d.; and Ambrose Shardlow, 3d. at 36s. 9d.

BRITISH OXYGEN CO., LTD. Interim dividend 4 per cent.

COVENTRY GAUGE & TOOL CO., LTD. Interim dividend 1½ per cent (tax free).

NOBLE & LUND, LTD. Interim dividend 4 per cent.

Standard for Machine Screws and Nuts

The Unified thread has been steadily gaining in popularity since it was introduced to British industry, but it is recognized that Whitworth threads must inevitably continue in use for a long time. A new edition of B.S.450 has therefore been issued to meet the need for an up-to-date standard for machine screws with B.S.W. and B.S.F. threads.

The general requirements in this revised standard are in most cases similar to those in B.S.1981 (Unified machine screws and machine screw nuts), but, since development is continually occurring in methods of manufacture, further advances in established practice have also been recognized. In addition, the scope has been considerably extended to include all the various types of heads in common use in both slotted and recessed forms.

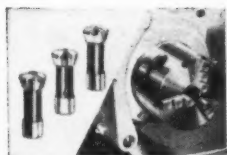
Copies of this standard (B.S.450:1958) may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1, price 12s. 6d. (postage will be charged extra to non-subscribers).

COMPANY		Denom.	Middle Price	COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.	Harper (John) & Co., Ltd.	Ord.	5/-	12/9xd
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	8/3	"	4½% Red.	£1	13/14
Allen (Edgar) & Co., Ltd.	Ord.	£1	30/6	"	Cum Prf.		
"	5% Prf.	£1	14/9*	Herbert (Alfred), Ltd.	Ord.	£1	35/-
Arnott & Harrison, Ltd.	Ord.	4/-	13/6	Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/6
Asquith Machine Tools Corp., Ltd.	Ord.	5/-	18/9	"	"B" Ord.	5/-	10/3
"	6% Cum. Prf.	£1	18/6	Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/3
Birmingham Small Arms Co., Ltd.	Ord.	£1	27/6	"	7% Cum. Prf.	5/-	5/-
"	5% Cum.	£1	15/3	Kayser, Ellison & Co., Ltd.	Ord.	£1	46/-
"	A" Prf.	£1	17/6	"	6% Cum. Prf.	£1	18/3
"	6% Cum.	£1	17/6	Kendall & Gent, Ltd.	Ord.	5/-	7/7½
"	7% Prf.	£1	17/6	Kerry's (Gt. Britain), Ltd.	Ord.	5/-	4/3
"	4% 1st Mors.	Stk.	86/-	Kitchen & Wade, Ltd.	Ord.	4/-	11/6
"	Deb.			Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
British Oxygen Co., Ltd.	Ord.	£1	36/6	Massey, B. & S., Ltd.	Ord.	5/-	8/3
"	6½% Cum. Prf.	£1	21/3	Modern Engineering Machine Tools	Ord.	5/-	10/7½
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	4/9	Ltd.			
Broom & Wade, Ltd.	Ord.	5/-	10/10½	Newall Engineering Co., Ltd.	Ord.	2/-	4/6
"	6% Cum. Prf.	£1	17/9	Newman Industries, Ltd.	Ord.	2/-	2/3
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	14/-	"	6% Prf. Ord.	5/-	5/3xd
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/9	Noble & Lund, Ltd.	Ord.	2/-	2/9
Butler Machine Tool Co., Ltd.	Ord.	5/-	6/3	Osborn (Samuel) & Co., Ltd.	Ord.	5/-	18/-
"	5% Cum. Prf.	£1	13/9	"	5½% Cum. Prf.	£1	26/-
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red.	£1	13/9	Pratt (F.) & Co., Ltd.	Ord.	5/-	21/3
"	Cum. Prf.			Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/-
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/9	Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	36/9
"	6% Cum. Prf.	£1	26/3	"			
Churchill Machine Tool Co., Ltd.	Ord.	5/-	17/7½	Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	11/6
"	6% Cum. Prf.	£1	18/6	Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	11/3
Clarkson (Engrs.), Ltd.	Ord.	5/-	12/6	"			
Cohen (George), Son & Co., Ltd.	Ord.	5/-	10/9	"	5% Cum. Prf.	£1	ex rights
"	4½% Cum. Prf.	£1	14/6	"	Ord.	5/-	15/-
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	14/3	Stedall & Co., Ltd.	Ord.	5/-	6/3
"	5% Cum.	£1	16/3	Tap & Die Corporation, Ltd.	Ord.	5/-	7/6
"	Red. Prf.			"	4½% Deb.	Stk.	82/-
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/9	"	1961-1977		
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/7½	Wadkin, Ltd.	Ord.	10/-	17/6
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/9	Ward (Thos. W.), Ltd.	Ord.	£1	79/0½
"	4½% Red.	£1	13/9	"	5% Cum.	£1	15/9
"	Cum. Prf.			"	1st Prf.		
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3	"	5% Cum.	£1	24/6
"				"	2nd Prf.		
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/-	Willson Lathes, Ltd.	Ord.	1/-	2/4½
Greenwood & Batley, Ltd.	Ord.	£1	48/1½				

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error.

* Sheffield price.

† Birmingham price.



Extra Work Holding Collets up to $\frac{1}{4}$ in. diameter capacity for direct fitting into the bore of the spindle. $\frac{3}{4}$ in. dia. 3-Jaw Precision Self Centring and 4-Jaw Independent Chucks supplied extra.

WORK SPEEDS		
Feet per Minute	Spindle Speeds (r.p.m.)	Spindle Speeds (r.p.m.)
160	75	6
280	140	2
410	200	3
530	260	4
660	325	5
780	380	6

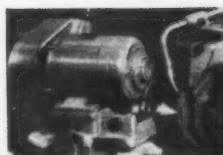
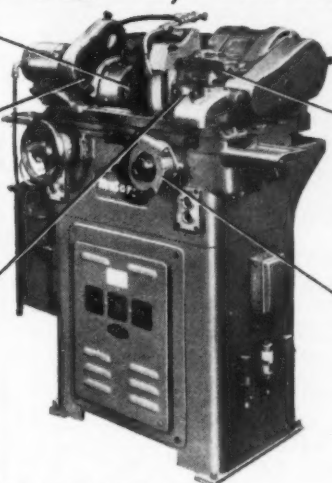
Work speeds for the 'Dead or Live' Workspindle are electrically regulated in two ranges of six speeds, the appropriate range being set by vee belt transfer, and the individual speed by selector switch.



Removable type Internal Attachment available (as extra equipment) for mounting on the front of the wheelhead. Grinding diameter: 0.25 in. to 3 in. (6.5 mm. to 75 mm.). Grinding depths to 3 in. (75 mm.).

MYFORD

MG-12 Grinder



The extra equipment 'live' spindle Swivelling Workhead features: Plug-in facility, Rapid changeover from standard, Large spindle flange, Reversing switch for face grinding, 12 spindle speeds 65 to 670 r.p.m., etc.



'Myford' Cartridge type wheel spindle unit with spindle of nitralloy steel. Single, graduated, collar adjustment. Easily replaceable. Ample capacity oil reservoir and circulating pump ensure constant lubrication.



Wheelfeed index dial engraved with 0.0001 in. divisions of infeed. Graduated thimble gives micrometer control of index representing 0.000025 in. infeed per division; dead stop for repetition work; hardened feed screw with ground thread.

Send for full details to:—
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PLATES, SURFACE TABLES, STRAIGHT EDGES, SINE TABLES **AND NOW...**



BOX ANGLE PLATES

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WINDLEY
PRECISION
PRODUCT



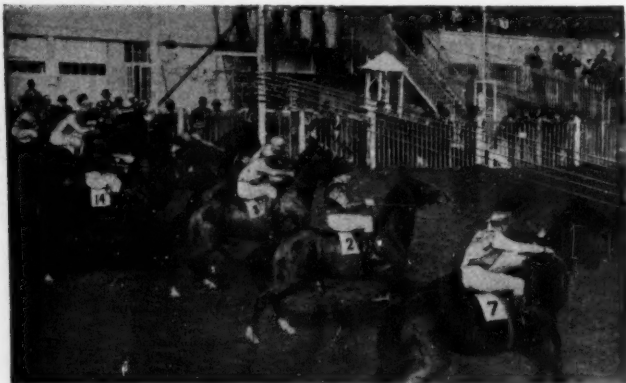
These box angle plates are grade "A" with a guaranteed accuracy of 0.0002 in. per foot, flat and square. They are manufactured in high duty cast iron with cored slots and machined "T" slots.

Sizes: 6 in. by 5 in. by $\frac{1}{4}$ in.
9 in. by 7 in. by $\frac{1}{4}$ in.
12 in. by 10 in. by $\frac{1}{4}$ in.
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WINDLEY BROS. LTD., CROWN WORKS, CHELMSFORD

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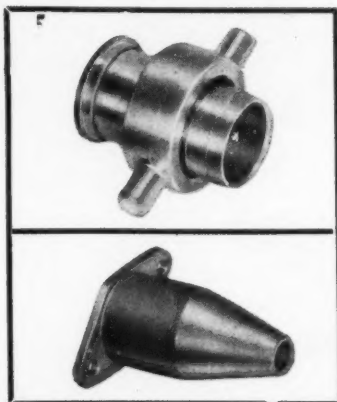
May we pick the winner for you . . .

When choosing between Die Castings or Hot Pressings you can count on us for sound, unbiased advice! We make both **HOT PRESSINGS** in **Brass, Bronze, Copper or Aluminium**, and **GRAVITY DIE CASTINGS** in **Brass, Bronze or Aluminium**. The unique experience of our organisation—two separate yet inter-related operations under one roof—will ensure that your choice is correct.

For a constant or phased supply of **DIMENSIONALLY ACCURATE PARTS** in **Brass, Bronze, Copper or Aluminium**—see us first! Our Technical Representatives are always at your service.

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- Patented flexible control of the platen.
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In addition to single cycle automatic operation giving controlled timing for injection, freezing and die opening, machines can now be supplied for zinc alloy casting with all the above features plus completely automatic operation to give 13 shots per minute.

Meet the challenge with EMB die-casting machines!


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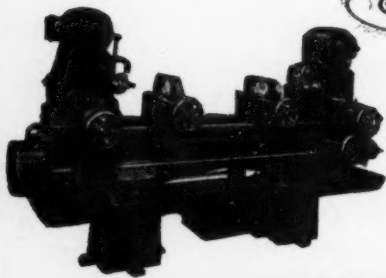
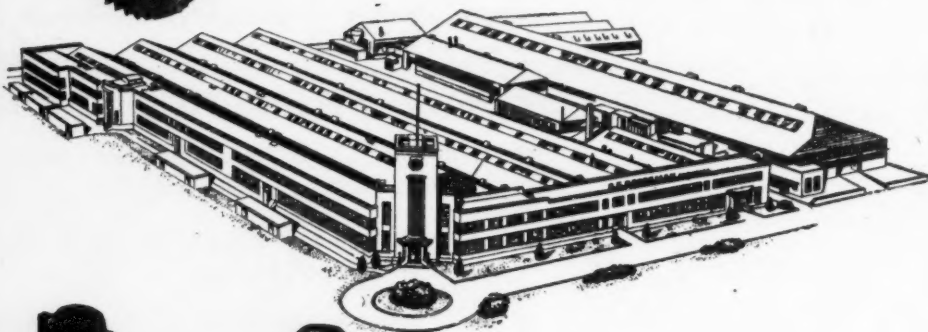
Confidence

*inspired by
experience...*



Experience harvested in almost a century's service to industrial undertakings, large and small, has inspired a well based confidence in both the products and manufacturing facilities of S. E. Opperman Ltd.

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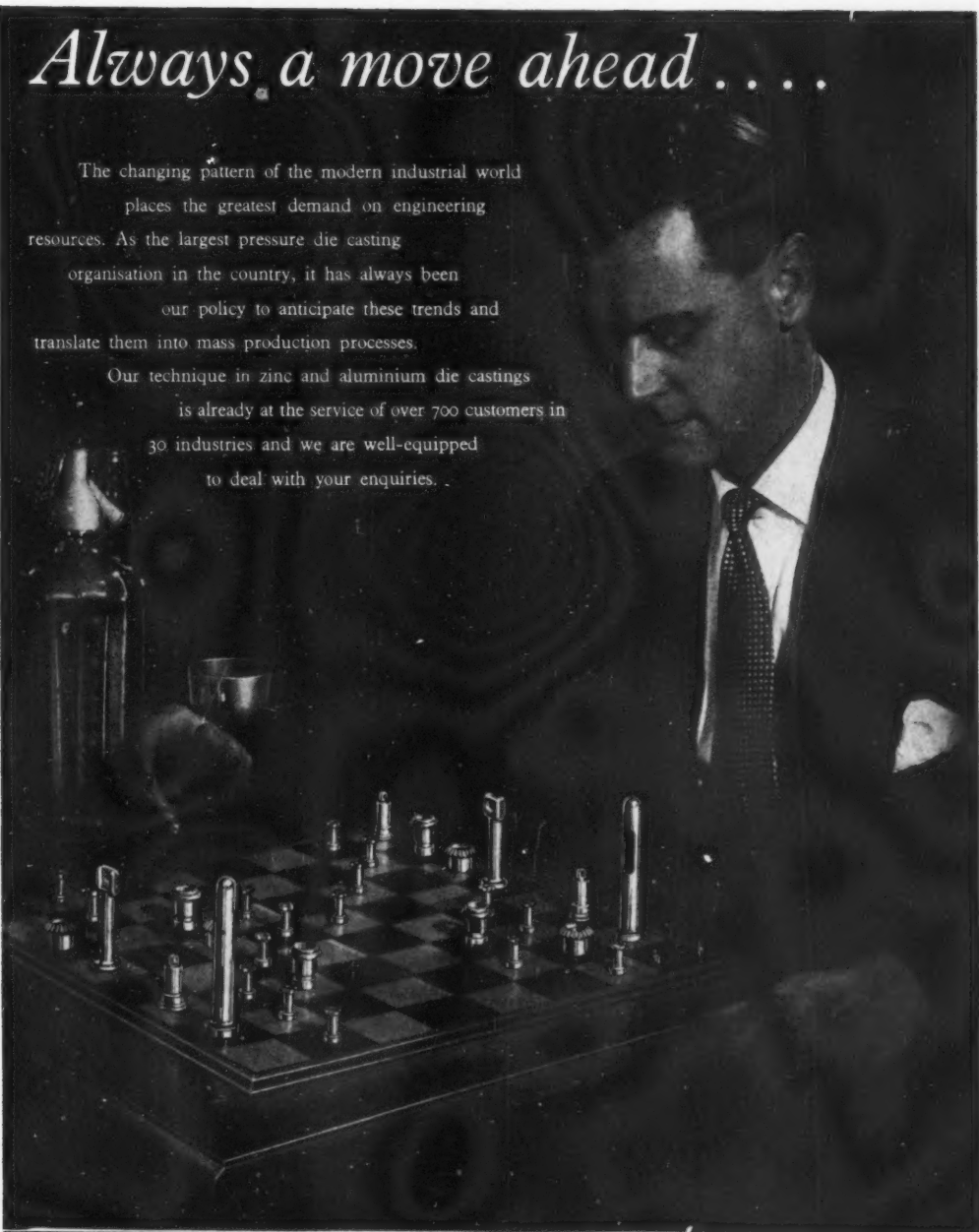
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The changing pattern of the modern industrial world places the greatest demand on engineering resources. As the largest pressure die casting organisation in the country, it has always been our policy to anticipate these trends and translate them into mass production processes.

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THE WOLVERHAMPTON DIE CASTING COMPANY LIMITED
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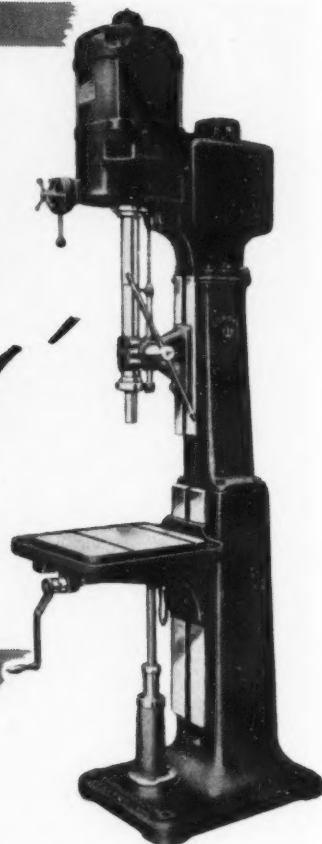
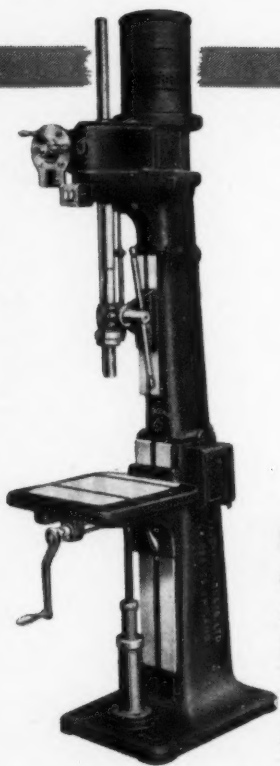
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MODEL 15 AY

ALL GEARED DRIVE
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FAST VERSATILE ECONOMICAL

SENTINEL UNIT MACHINES incorporating the Renault-France system electro-mechanical heads.

Built for—Drilling, Boring, Facing and Chamfering. 8 different types of Manifolds (see inset). Two manifolds are loaded, pneumatically located and clamped.

Press a button to start—and in less than 30 seconds the machining cycle is completed!

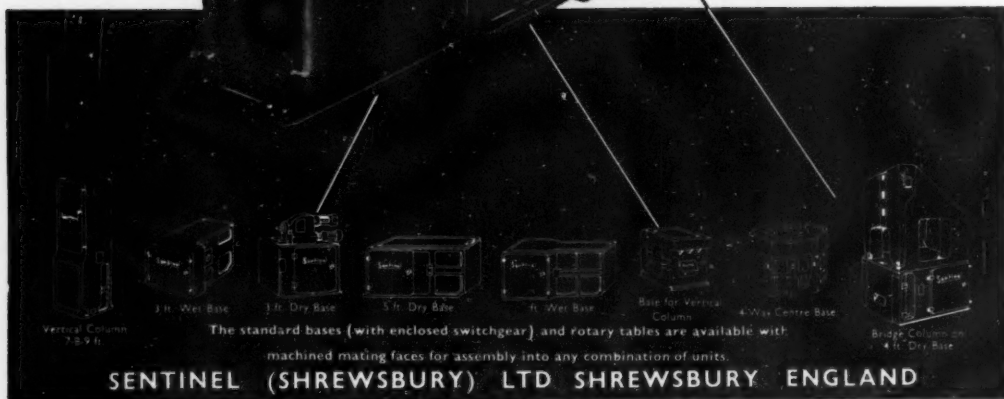
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The Famous



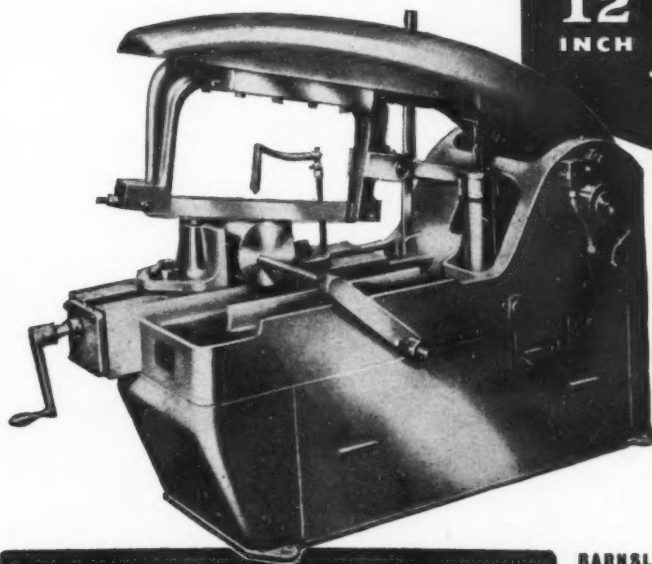
SAWMASTERS

The worlds finest
range of heavy duty
machine saws

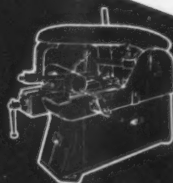
Built on modern lines to secure maximum working efficiency, the Q. & S. "Sawmaster" Machine Saws incorporate all the essential features for rapid and accurate cutting.

All models have fully adjustable feeds, hydraulic relief to return stroke, automatic raising of bowslide on completion of cut, totally enclosed drive, and heavy duty swivelling vices.

The three larger models have lever gear change, giving immediate selection of correct cutting rate.



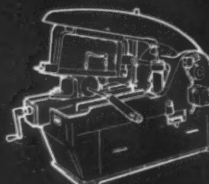
6
INCH



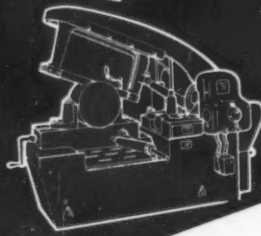
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10
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12
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Illustrated: 10 inch "Sawmaster"

Your machine tool merchant
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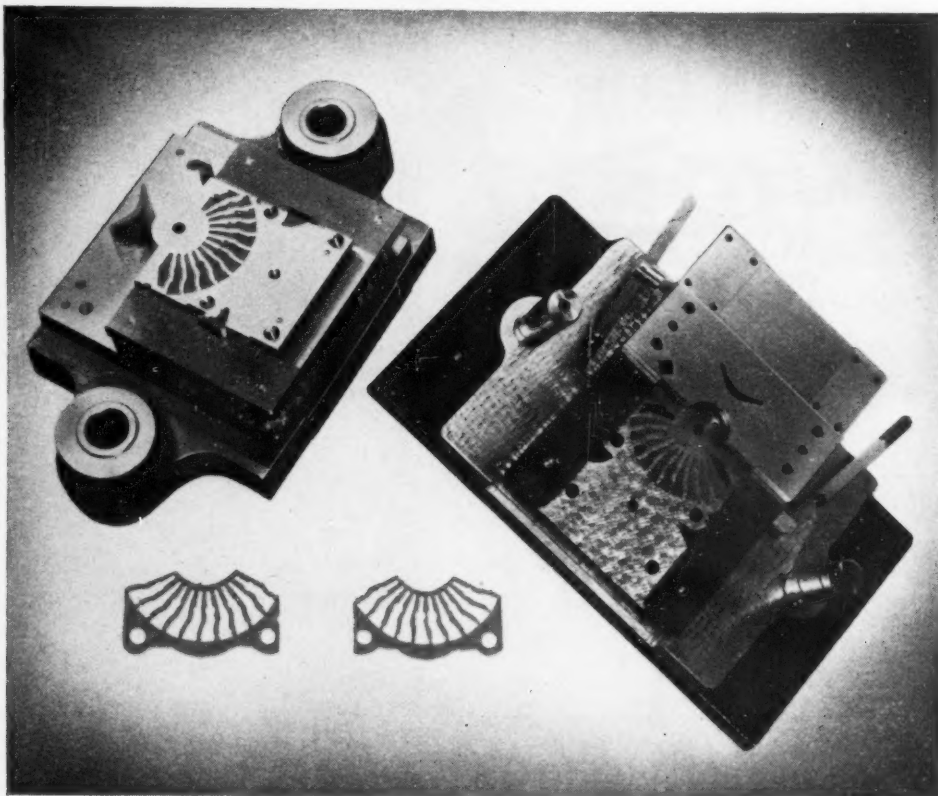
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MOISTOP offers an impermeable and almost untearable protection. **MOISTOP** is a **SISALKRAFT** product reinforced in two directions with unspun Sisal fibres running in the longitudinal and cross planes, these fibres being totally enclosed by two layers of high grade bitumen, which in turn are faced with tough kraft paper, and one surface is coated with a layer of **POLYTHENE**.

The result of this combination is an effective moisture vapour barrier that combines the strength of **SISALKRAFT** with the virtues of **POLYTHENE**.

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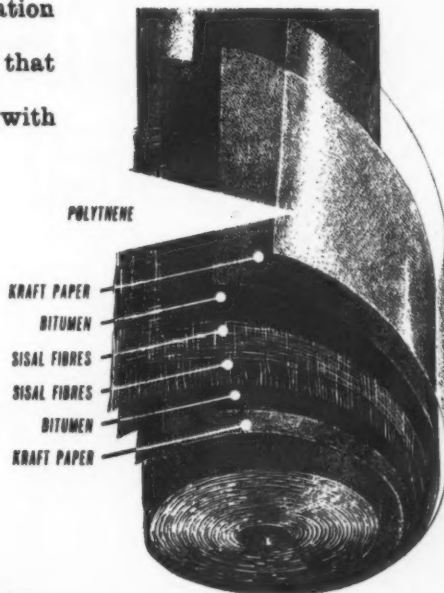
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holding limits of
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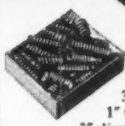
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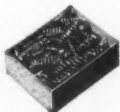


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3 doz. Assorted
Light Compression
Springs. 1" to
4" long, 22 to 18 S.W.G.,
 $\frac{1}{8}$ " to $\frac{1}{2}$ " diam. 6/6 each.

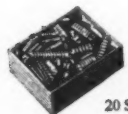
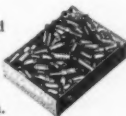


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3 doz. Assorted
1" to 4" long, $\frac{1}{8}$ " to
 $\frac{1}{2}$ " diam., 19G to 15G.
5/6 each.

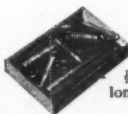
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Extra Light Compression. 1 gross
Assorted. $\frac{1}{8}$ " to
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15/- each.



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Small Expansion
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Fine Expansion
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No. 1024.
20 Compression Springs 12" long.
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Expansions $1\frac{1}{2}$ " to 12" long, 5/32" to $\frac{1}{2}$ "
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...compression, 18 S.W.G. x $\frac{5}{16}$ x 2", 17 coils?

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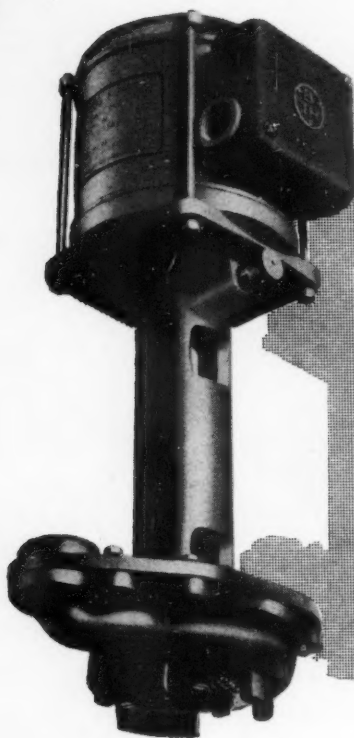
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HERBERT TERRY & SONS LTD · REDDITCH · WORCS
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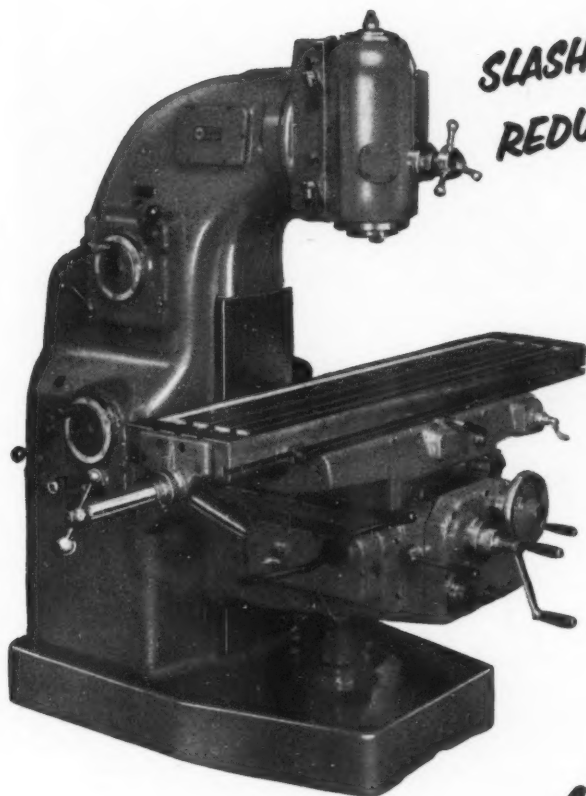
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3 L D I A L T Y P E

***SLASHES PRODUCTION COSTS!
REDUCES OPERATOR FATIGUE!***



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- ★ Spindle stop, feeds and rapid traverses by single lever.
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- ★ Hardened and ground gears.
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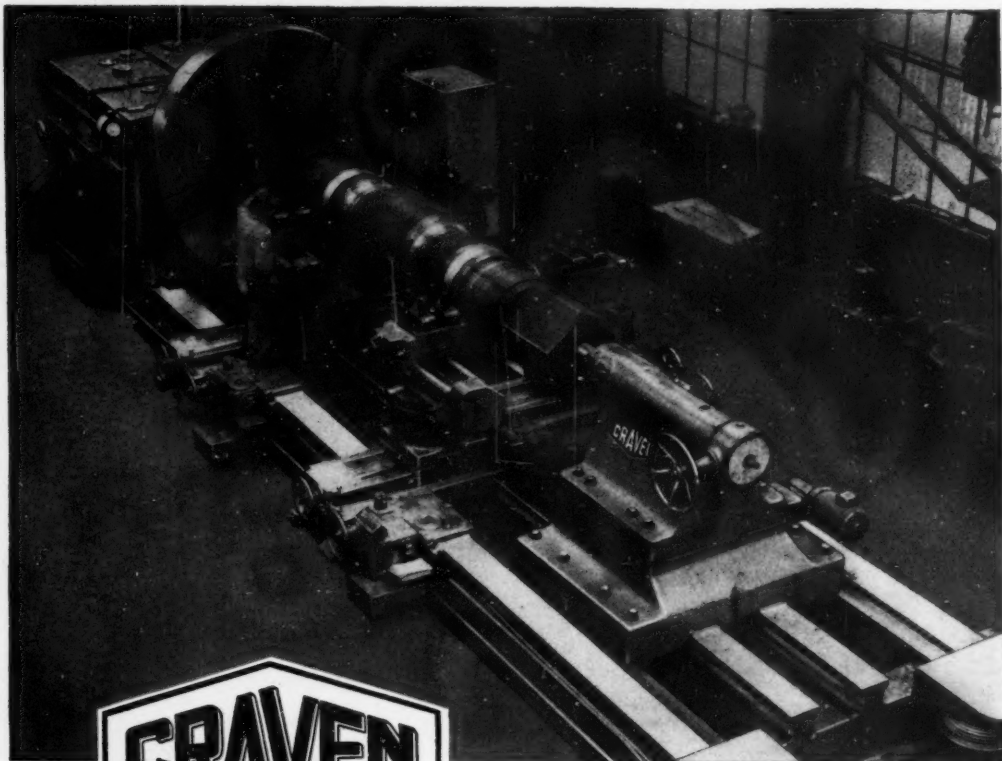
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Heavy Duty Lathes for All Purposes

From 16in. to 100in. Height of Centres

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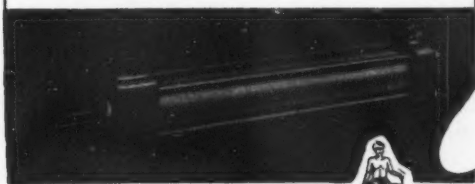
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MODEL **CAPACITY 11" × 18"**
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... also available with capacity of
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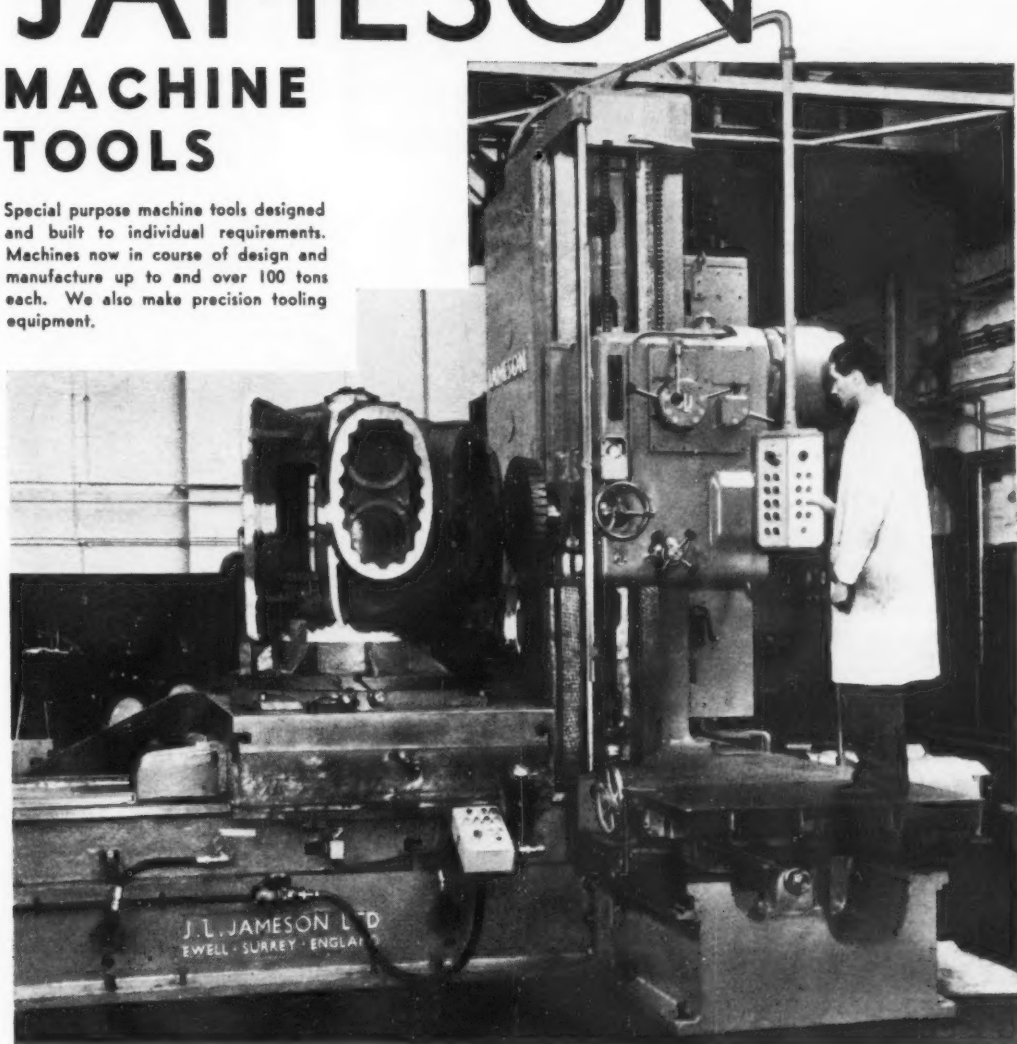
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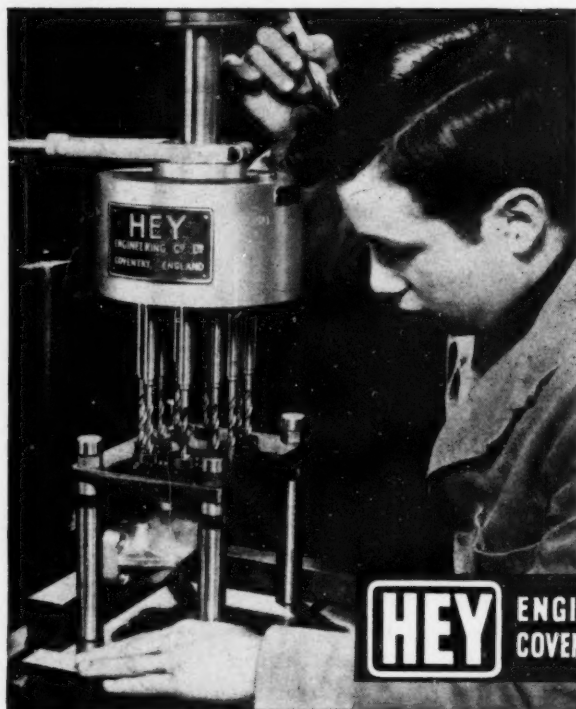
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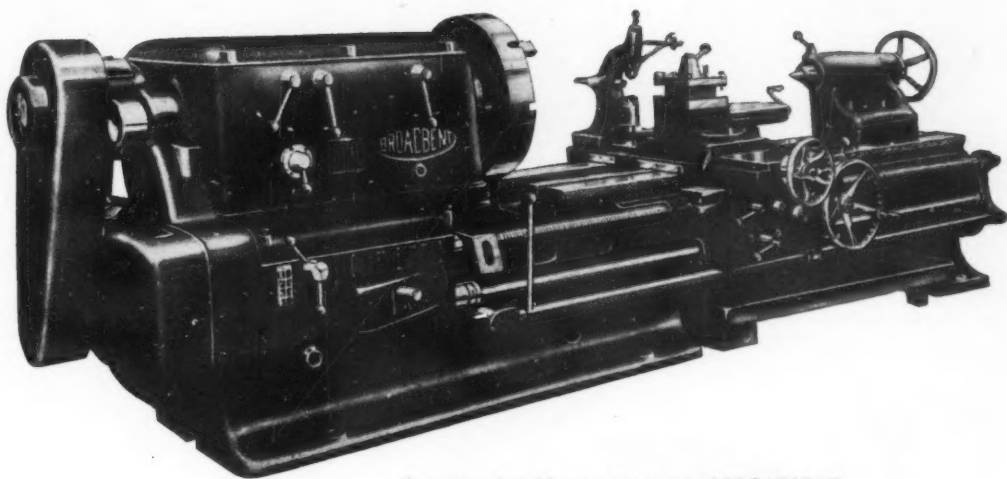
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We also manufacture Rotary Cams and Profile Milling Machines, Short Thread Milling Machines, Gear Tooth Rounding Machines, Tapping Machines, End Facing and Centring Machines, Special Machine Tools for High Production.

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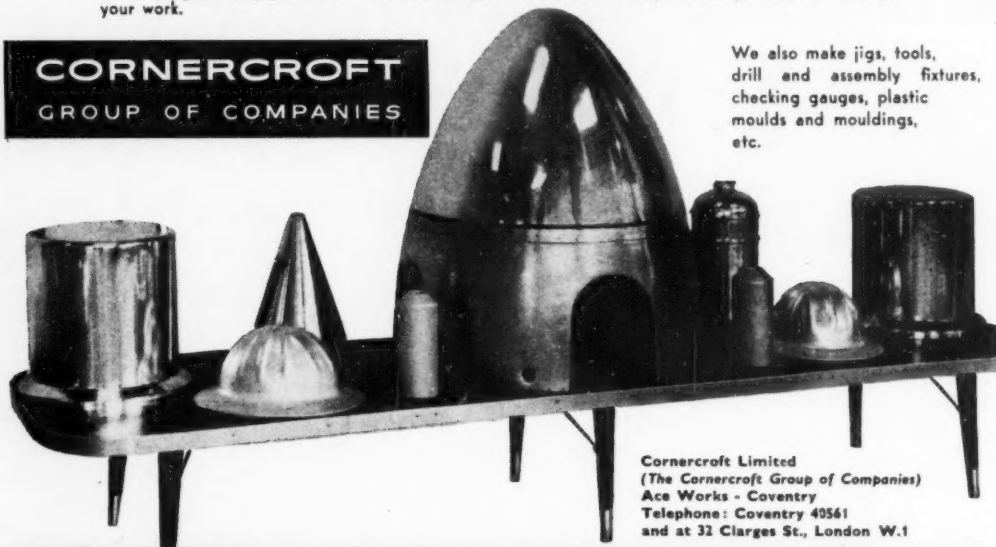
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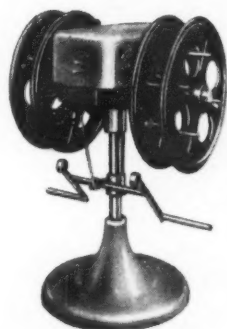
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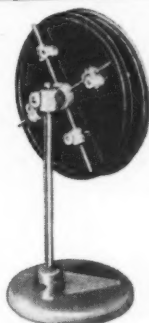
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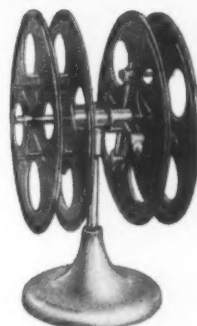
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DOUBLE-SIDED MOTORISED
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Max. outside coil dia. ... 22in.
Min./Max. inside coil dia. 7/17in.
Maximum width of coil ... 6in.
Max. weight of coil ... 280 lb.
Feed 0-35 ft./min.



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Max. outside dia. of coil... 22in.
Min./Max. width of coil... 7/17in.
Max. coil width ... 6in.
Max. weight of coil ... 3 cwt.
Also available in larger size.



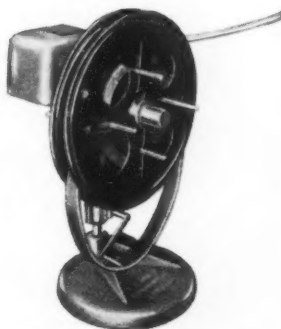
**DOUBLE-SIDED VERTICAL
MODEL A36.**

Max. outside dia. of coil... 22 or 34in.
Min./Max. inside dia. of
coil 8/17in.
Max. width of coil ... 6in.
Max. weight of each coil... 4 cwt.



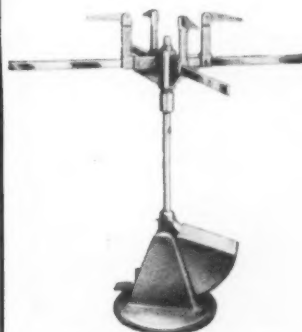
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This model is mainly intended for wire coil. The automatic brake effectively prevents over run of stock.
Dia. of platform ... 36in.
Inside dia. of coil ... 9in.
Max. weight of coil ... 2 cwt.



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Min./max. inside coil dia. 7/17in.
Max. width of coil ... 6in.
Max. weight of coil ... 3 cwt.
Feed 0-35 ft./min.



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Max. outside coil dia. ... 30in.
Min./Max. inside coil dia. 12/18in.
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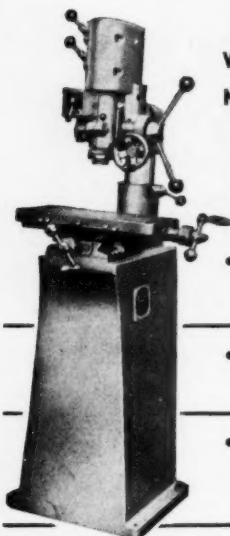
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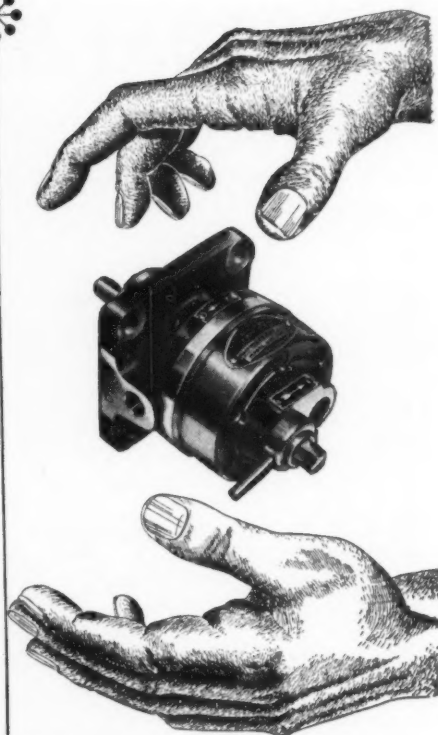
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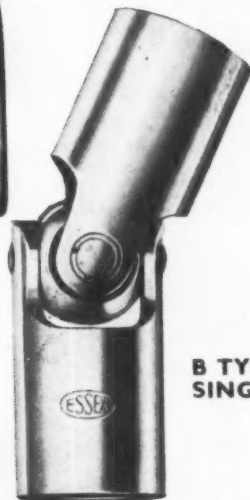
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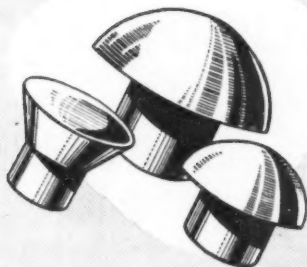


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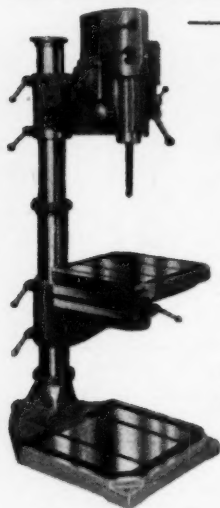
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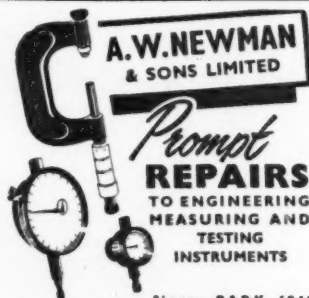
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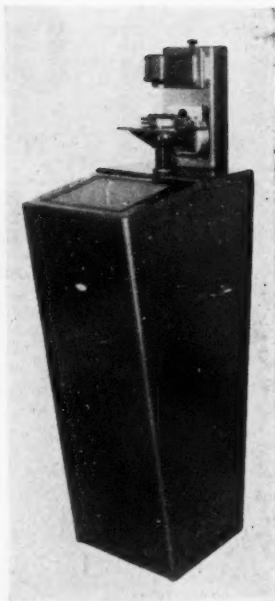
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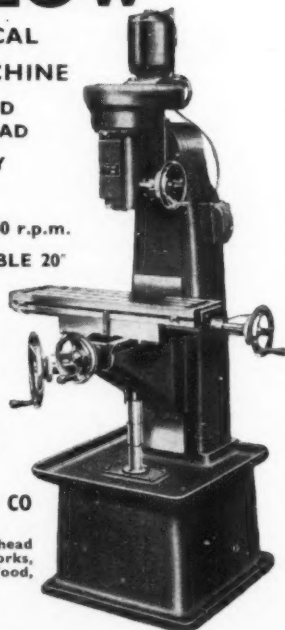
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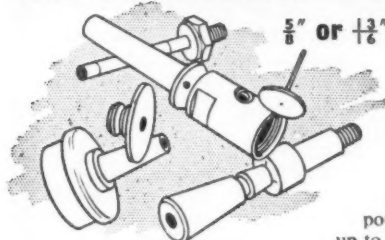


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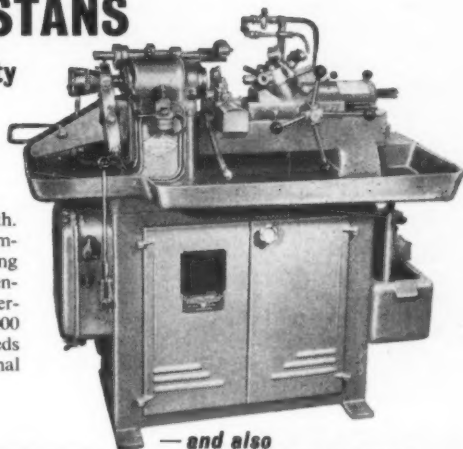
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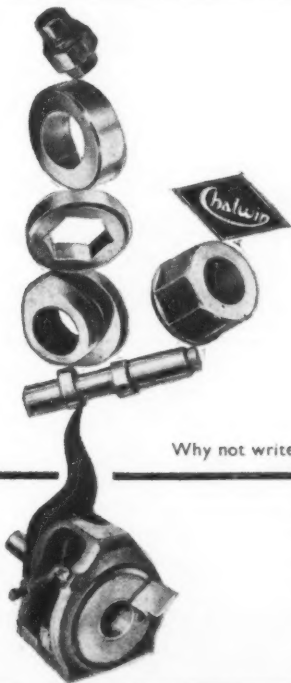
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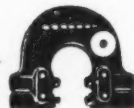
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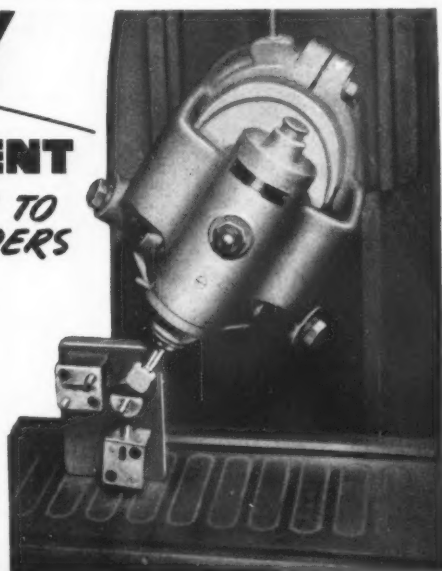
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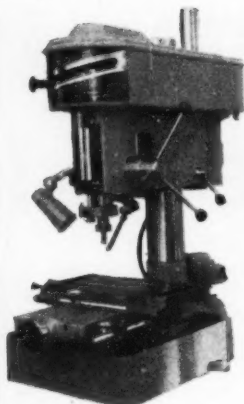
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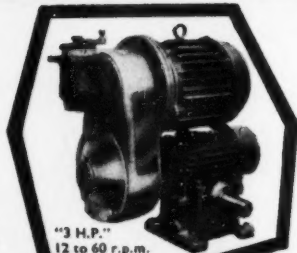
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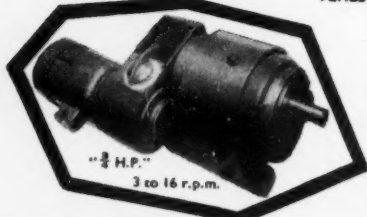
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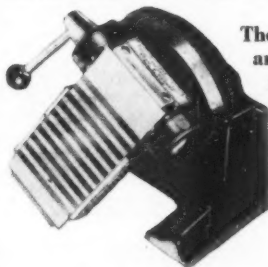
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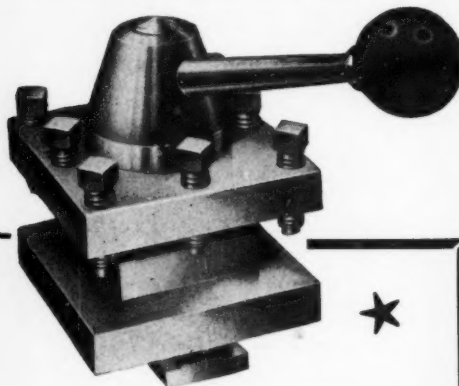


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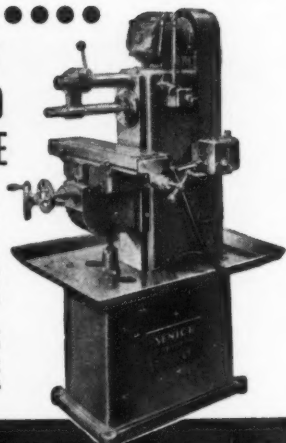
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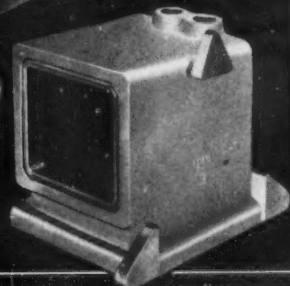
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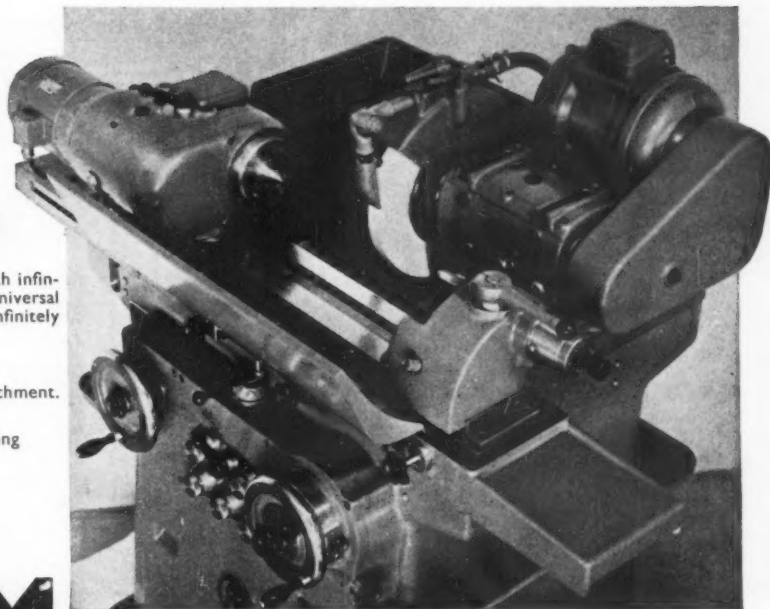
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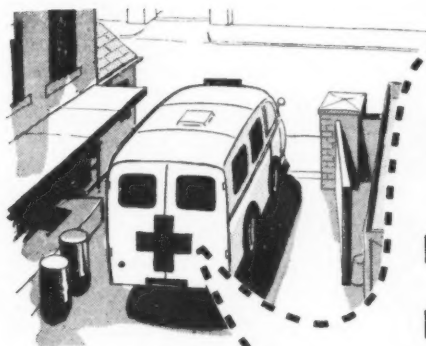


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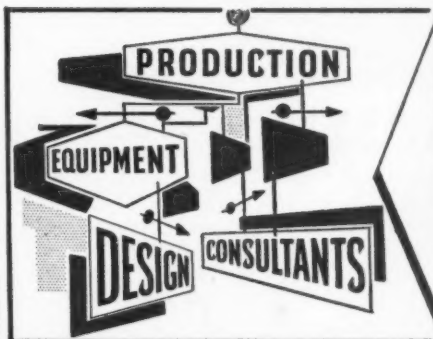
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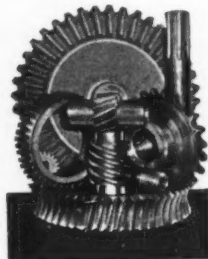
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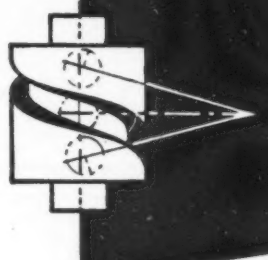
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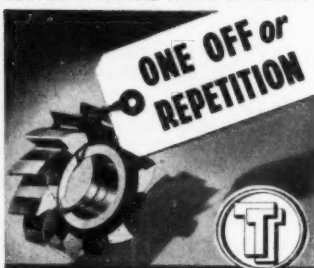
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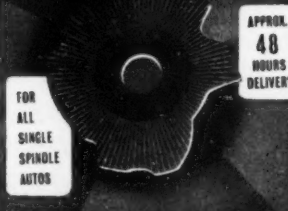
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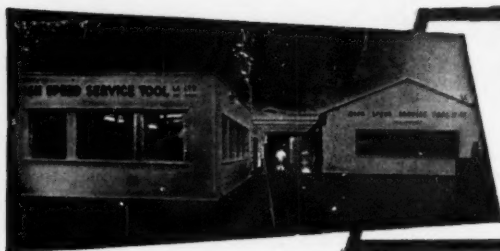
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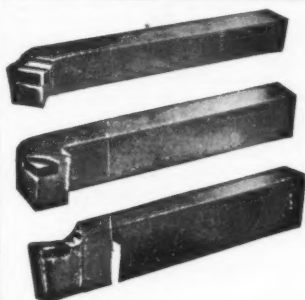
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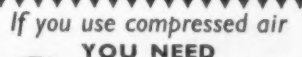
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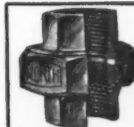
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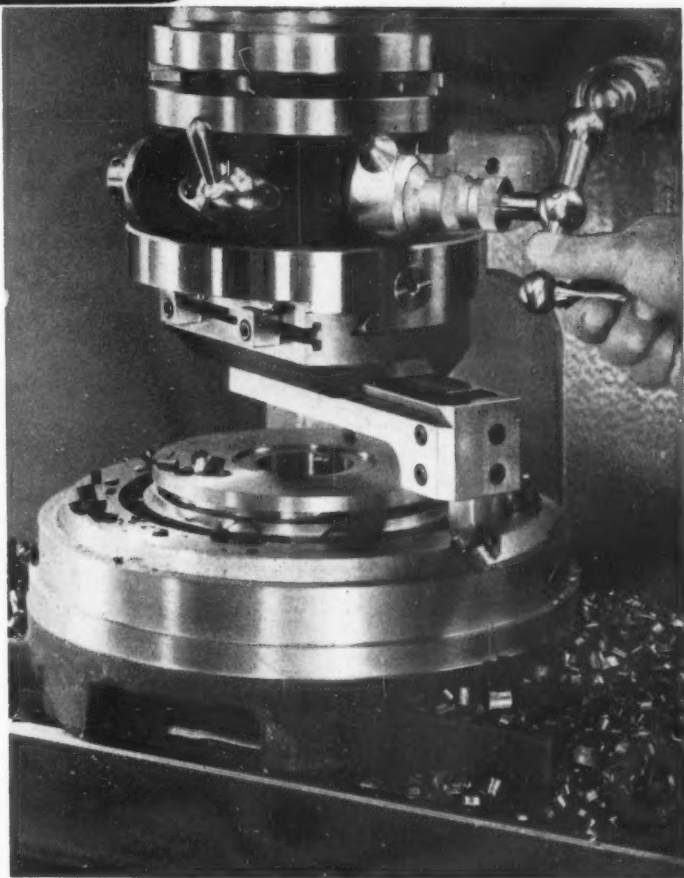
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Scriven 3-Roll Plate Bending Machine, rollers 14ft wide, 1in. capacity.

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Herbert Filing and Sawing Machine, 15in. square adjustable table.

Alexander 16in. Cutting-off Machine, 12 $\frac{1}{2}$ h.p., 400/3/50.

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'Fielding' single compression Scrap Metal Baling Press.

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Depth of box when cover closed: 18in.

Size of bale: 36in. by 18in. by 10in. to 12in.

Weight of bale approx.: 3 to 4 cwt.

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Preliminary pressing power, cover ram:
208 tons.

Specific pressure on material: 5 tons per
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Power of horizontal ram: 208 tons.

Specific pressure on material: 46 tons per
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Stroke of horizontal ram: 73in.

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Motor driven high speed oil pump
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40 g.p.m. at 1,500 lbs. per sq. inch.

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50 h.p., 720 r.p.m. T.E.S.C., complete
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Oil immersed Star Delta.

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Gap Bed Centre Lathe, 8 $\frac{1}{2}$ in. height by
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Chucking Machine—£485. Collet & Bar
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New Britain 6-spindle Chucking

auto. Model 656, with equipment. U.S.A.
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HERBERT Junior Chucking Auto. Very well equipped.

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BROWN & SHARPE No. 2 Universal Grinder. 14in. swing by 30in. b.c. Well equipped. First-class condition.

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BIERNATZKI Heavy Duty Horizontal Miller. Speeds 29 to 1,500 r.p.m. Quick power all ways. As new condition. 1952.

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HERBERT No. 21 Combination Turret Lathe. 34in. swing. 7½in. hollow spindle. Screwcutting and taper-turning.

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ARCHDALE 24in. Vertical Miller. Swivelling and sliding head.

HERBERT 155 Vertical Miller.

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BRADLEY, BILSTON, STAFFS. Bilston 42471/7

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GIDDINGS & LEWIS 25RT Hor. Borer.
WARD 1A, 2A Capstans.
HERBERT No. 1, 25, 28, 45, 48S Capstans.
HERBERT 3A (Chucking) Capstan.
WARNER & SWASEY No. 2, 3 and 5 Capstans.
PALLAS No. 2 Surface Grinder.
NORTON 18in. by 6in. Surface Grinder.
CHURCHILL 'HDY' Internal Grinder.
HEALD 72A Internal Grinder.
WOTAN Internal Grinder.
PRECIMAX 10in. by 48in. Plain Grinder.
MAXNOVA Profilomatic Type B. Copying Lathe.
HOLBROOK 8in. by 36in. S.S. & S.C. Lathe.
CHURCHILL-REDMAN 8in. by 30in. A.G.H. Gap Bed Lathe.

PROGRESSIVE 8in. S.S. & S.C. Gap Bed Lathe.
KARGER 5in. by 24in. S.S. & S.C. Lathe.
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VOLMAN 7in. by 60in. A.G.H. Gap Bed Lathe.
CINCINNATI 3/36 Hydromatic Duplex Mill.
WADKIN Vert. Mill. 2,100 to 3,100 r.p.m.
CINCINNATI No. 3 Vertical Mill.
CINCINNATI Hydrotel Mod. EM. 28in. Vertical Mill.
MANN Universal Thread Mill.
ADCOCK & SHIPLEY No. 3 Hor. Mill.
ARCHDALE 30in. Vertical Mill.
EDGWICK No. 1 Speedmill.
SENTINEL 25T Power Press.
C.V.A. 25T Dieing Press.
WADKIN Fixed Head Router.
Variable Speed H. GEAR Units, 3 h.p.

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Thiel 58 Duplex Tool Milling
Machine with universal milling table. Motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 78101.

INDEX S.S. AUTOMATICS

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No. 18. ½in. £455.
400/3/50 Electrics.

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Adcock & Shipley 3ft. Radial
Arm Drill, loose box bed, 1948 machine.
£300.—A. McNAMARA & CO., New Line,
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Heavy 12ft. by ½in. Plate Bending
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TAYLOR & CHALLEN Type B1 Open Fronted Upright Power Press. Mounted on cast iron legs. Arranged motor drive for 400-440/3/50. Pressure exerted 2 tons. Stroke 11in. Size of bed 14½in. by 10½in. Hole in bed 5in. diameter. Treadle operated clutch.

TURNER BROTHERS Type TB20 Geared Open Fronted Upright Power Press with steel plate frame. Arranged motor drive for 440/3/50. Guards covering drive and gearing. Complete with Udal automatic operator's safety guard. Pressure exerted approximately 20 tons. Stroke 4in. Size of bed 24½in. by 16½in. Hole in bed 8in. by 11in. Weight approximately 35 cwt.

TAYLOR & CHALLEN Type B3 Open Fronted Upright Power Press with the bars. Pressure exerted approximately 40 tons. Stroke 3in. Size of bed 27½in. by 17½in. Hole in bed 12in. diameter. Weight approximately 40 cwt.

BESCO Type E81 Eccentric Power Punching Press, with adjustable stroke and adjustable table. Arranged motor drive for 400-440/3/50. Pressure exerted approximately 10 tons. Stroke adjustable from 1in. to 1½in. Size of table 16½in. by 12½in. Hole in table 6in. by 4½in.

HENRY & WRIGHT 50-ton 4-Column Dieing Press with double roll feed. Arranged motor drive for 415/3/50. Motor mounts on slide rails on floor. Complete with six bolsters of various sizes. Pressure exerted 50 tons. Stroke 2in. Between columns 13½in. by 13½in. Size of bed 24in. by 23½in. Hole in bed 13in. by 8½in. Weight approximately 75 cwt.

WESTON Model 400/100 Double Slided Friction Screw Press, of welded steel plate construction. Arranged motor drive for 400/3/50. The machine is fitted with air operated sliding tables at front and back of bed to facilitate loading of work under dies. Pressure exerted approximately 120 tons. Maximum stroke 11in. Diameter of screw with four starts 6½in. Size of bed 21½in. by 18in. Weight approximately 5 tons.

Photographs of the above are available. MACHINE TOOLS, NEW AND USED, Of Every Description. Attractive Prices.

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Telephone: EUSTON 4681-3771.

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Richmond HB3/12 (New) 4ft. 6in.
Radial Drilling Machine, 2in. capacity, motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

Secondhand:

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Riveter. M.d. 400/3/50.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1. Phone: TERminus 0167/8/9.

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OLDFIELD & SCHOFIELD Boring and Surfacing Lathe, cross-traversing Turret type.

LE BLOND Regal Centre Lathe, 9½in. by 42in. between centres.

URQUHART LINDSAY & ROBERTSON ORCHAR Centre Lathe, 16in. by 30ft. 6in. between centres.

LIBBY Model 2H-8 Combination Turret Lathe, 8½in. hollow spindle.

NILES Centre Lathes, 15in. centre height by 28ft. between centres. (Two available.)

AUTOMATICS

ACME GRIDLEY Model RA6 2½in. spindle Bar Automatic.

BULLARD 11in. eight-spindle Vertical Chucking Automatic.

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ARCHDALE 5ft. Radial Drilling Machine, low base, No. 4 M.T. in spindle. A.C. Motor drive (two motor type).

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HERBERT No. 95 Combination Turret Lathe, 415/3/50, 4½in. Hollow Spindle. Good equipment.

WARD No. 8 Combination Turret Lathe, 415/3/50, 4½in. Hollow spindle. Taper turning attachment.

WARD No. 2A Capstan Lathe, 415/3/50. Power feed to turret and saddle. Bar feed and automatic ball chuck. Two speed motor.

CHURCHILL-REDMAN 7-NM S.S. & S.C. Heavy Duty Gap Bed Lathe. All-Geared, 400-440v./3/50. Q.C.G.B. Admits 2ft. 3in. between centres, swing in gap 26in. dia. 2½in. H.S. Taper turning attachment.

LODGE & SHIPLEY S.S. & S.C. Manufacturing Lathe. All-Geared Head. 18in. swing by 5ft. between centres. 1½in. Hollow spindle. Q.C.G.B.

LE BLOND REGAL S.S. & S.C. Precision Lathe for bench mounting. 10in. swing by 2ft. 2in. between centres. Q.C.G.B. 3in. Hollow spindle All-Geared head, 415/3/50.

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WICKSTEED 8in. £208

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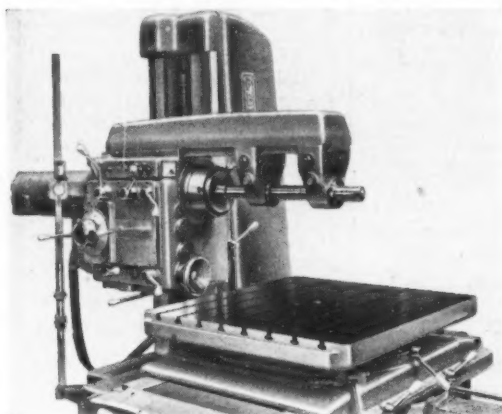
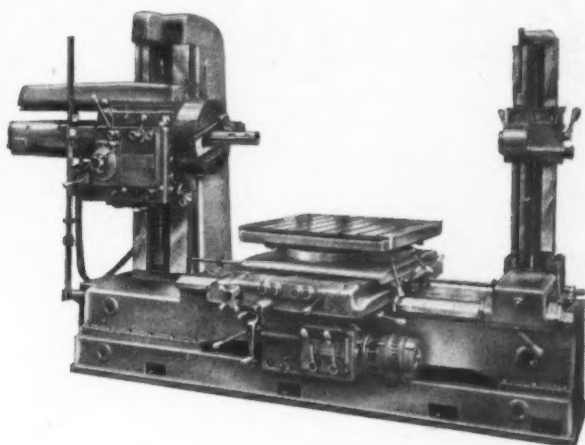
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Spindle dia.	3½in.
Range of speeds	35-1,200 r.p.m.
Traverse	24in.
Size of Table	39in. by 34in.
Rotates through	360 deg.
Max. distance spindle to table	35in.
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Max. distance facing head to outer support	88in.
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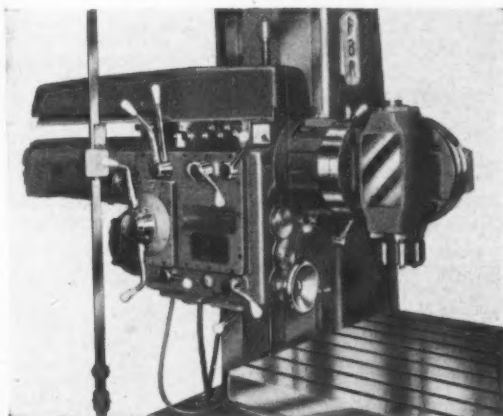
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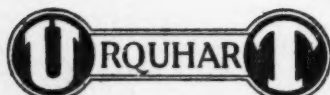


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BOLEY & LEINEN Precision Capstan. Model S.R.20. Collet cap. 1in., mot. 415/3/50.

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WADKIN High-speed Vert. Mill, table 12in. by 36in., mot. 415/3/50.
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K.S. Internal Grinder, 1/2 in. to 1 1/2 in. dia., int. cap. Power feed to table, auto. sizing feeds, mot. 415/3/50. Late type machine, ex. con.
OLIVETTI Automatic Hydraulic Cylindrical Grinder. Type R4/1200, 14in. swing by 45in. between centres. Plunge cut. Mot. 415/3/50.

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PRATT & WHITNEY Slotter, 5 1/2 in. stroke, tilting ram.

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OLIVER Quick Work Shear, cap. 1in., throat 30in.
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Production Miller, 400-440/3/50. Table 66in. by 12 1/2 in.; long, traverse 48in. Automatic cycle, 10 spindle speeds, 30-200 r.p.m. Double overarms.—LEE & HUNT, LTD., Crocus Street, Nottingham.

Victoria (New) U2 Universal

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Classified Advertisements (SITUATIONS VACANT, contd.)

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Designers are required at Hoover Limited. The first two for Senior Die and Mould Designers, the third for a Press Tool Designer, experience in multi slide progression tools and general press work. Both positions call for minimum qualification of O.N.C. together with an Indentured Apprenticeship. Age 25-40. Salary for men with the above qualifications and good experience at 25 is £15 3s. 0d. per week, plus Bonus. — Apply in writing stating age, qualifications and experience to the **EMPLOYMENT OFFICER, HOOVER LIMITED, Pershore, Greenford, Middlesbrough**.

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A Senior Planning Engineer required with extensive practical experience on medium/heavy machine tool type of product including machining, assembly, tool design, rate fixing, etc. Experience in plant study and synthetics would be advantageous. London area.—Please state age, education and full details of apprenticeship and subsequent experience with expected salary in confidence to BOX Z188, MACHINERY, Clifton House, Euston Road, N.W.1.

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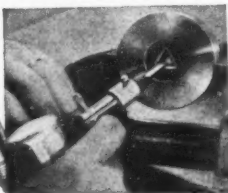
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